National Oceanic and Atmospheric Administration

NOAA Research Scientific Computing Support
(*Exhibit 300 UPI Code: 006-48-01-13-01-3504-00)*

Operational Analysis

October 2008 – September 2009 (FY09)

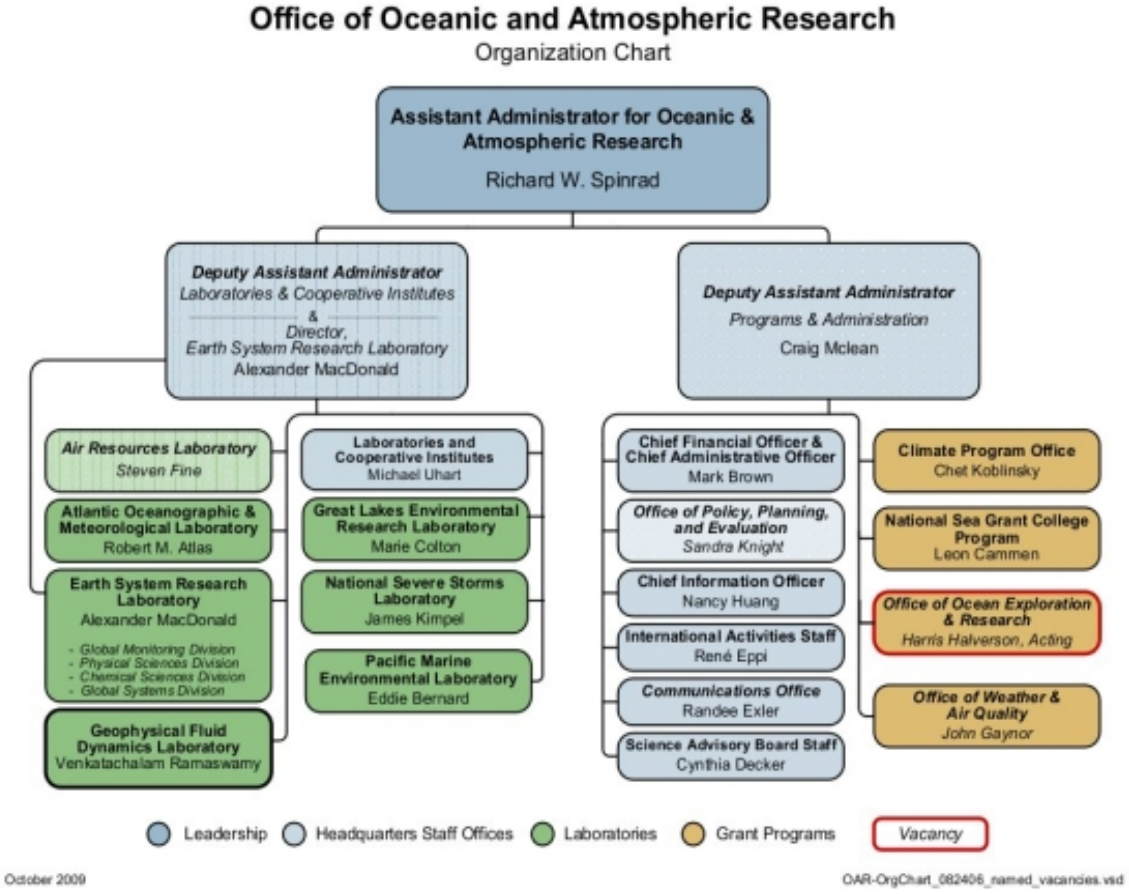
Executive Summary

NOAA Research Mission Statement

To conduct environmental research, provide scientific information and research leadership, and transfer research into products and services to help NOAA meet the evolving economic, social, and environmental needs of the Nation.

NOAA Research Vision Statement

Societally relevant research that forms the scientific basis for more productive and harmonious relationships between humans and their environment.



NOAA Research activities contribute to NOAA's mission goals to:

- *Protect, restore, and manage the use of coastal and ocean resources through ecosystem -based management,*
- *Understand climate variability and change to enhance society's ability to plan and respond,*
- *Serve society's needs for weather and water information, and*
- *Support the Nation's commerce with information for safe, efficient, and environmentally sound transportation.*

NOAA's research, conducted through the Office of Oceanic and Atmospheric Research (OAR), is the driving force behind NOAA environmental products and services that protect life and property and promote sustainable economic growth. Research, conducted by programs within NOAA and through collaborations outside NOAA, focuses on enhancing our understanding of environmental phenomena such as tornadoes, hurricanes, climate variability, changes in the ozone layer, El Niño/La Niña events, fisheries productivity, ocean currents, deep sea thermal vents, and coastal ecosystem health. NOAA research also develops innovative technologies and observing systems. The NOAA Resear ch network consists of internal Research Laboratories, programs for Undersea Research and Ocean Exploration, a grants program through the Climate Program Office, external research at Sea Grant universities and programs, and Cooperative Joint Institutes with academia. Through NOAA and its academic partners, thousands of scientists, engineers, technicians, and graduate students participate in furthering our knowledge of natural phenomena that affect the lives of us all.

NOAA's research serves diverse custom ers. The average citizen benefits through earlier warnings of threatening weather, healthier coasts and fisheries, or a broader understanding of environmental processes. The private sector uses NOAA data to make business decisions and also employs technolo gy developed and transferred by NOAA scientists. Federal agencies, state governments, and local authorities rely on NOAA research expertise for the sound scientific basis of crucial policy decisions related to environmental protection and restoration strategies. NOAA researchers are recognized as international leaders on environmental issues. With their international counterparts, NOAA scientists contribute to the understanding and assessment of issues such as ozone depletion and climate variability which must be addressed worldwide to ensure success.

NOAA and the nation depend on the cutting-edge science provided by its research programs. Recently, NOAA Research built much of the foundation for the modernization of the National Weather Service. The research programs provide the sound science necessary to help NOAA achieve her goals to:

- serve society's needs for weather and water information;
- lead the effort to understand and monitor climate variability and change to enhance society's ability to plan and respond;
- work to protect, restore and manage the use of coastal and ocean resources through ecosystem -based management; and
- support the Nation's commerce with information for safe, efficient and environmentally sound transportation.

Working under the broad themes of Climate, Weather and Air Quality, and Ocean and Coastal Resources, NOAA scientists study the ocean's depths and the highest reaches of space to better understand our environment. NOAA's long-term commitment to the highest quality research includes engaging in-house and extramural talent to:

- continue to conduct experiments to understand natural processes (physical, geochemical, ecological);
- build predictive models for use in weather, climate, solar, ocean, and coastal assessments and predictions;
- develop and deploy new observing technologies to provide data to support predictive models and to document natural variability;
- develop new analytical and forecast tools to improve weather services;

- use new information technology to share information with other federal and academic scientists; and
- prepare scientific assessments and information products to enhance public education and guide governmental action.

Research plans and products are developed in partnership with academia and other federal agencies, and are peer-reviewed and widely distributed. A high premium is placed on external collaboration both domestically and internationally. In addition, personnel management practices of hiring, promotion, and awards are based on demonstrable capability through internal and external peer assessment. Peer review, collaboration, and partnerships ensure that NOAA's research is of the highest quality and remains focused on critical issues.

Most of the environmental questions our nation and the world face are not easily answered. A strong NOAA is necessary to tackle the complex issues that only advanced scientific knowledge is able to adequately address. NOAA Research answers the call and:

- provides comprehensive knowledge to guide national environmental policy decisions, including better predictions of the climate response to emissions changes, choices for protection of the ozone layer, and alternatives for developing coastal communities;
- improves environmental services to the nation, including reliable predictions and assessments; and
- promotes economic growth through science for decision-making, new technology, and partnerships with academia and industry;

NOAA is a world leader in environmental science today and is well positioned and organized to provide the sound scientific research policy-makers will always need.

Appendix A provides a brief summary of the science performed by each Laboratory within NOAA Research.

1.0 Customer Results

1.1 Customer Requirements and Costs

NOAA's research serves diverse customers. The average citizen benefits through earlier warnings of threatening weather, healthier coasts and fisheries, or a broader understanding of environmental processes. The private sector uses NOAA data to make business decisions and also employs technology developed and transferred by NOAA scientists. Federal agencies, state governments, and local authorities rely on NOAA research expertise for the sound scientific basis of crucial policy decisions related to environmental protection and restoration strategies. NOAA researchers are recognized as international leaders on environmental issues. With their international counterparts, NOAA scientists contribute to the understanding and assessment of issues such as ozone depletion and climate variability which must be addressed worldwide to ensure success.

The scientific computing needed to support NOAA's research is a steady state investment. It is critical to provide an infrastructure that delivers Program products and services using information technology solutions that meet the needs of the science and the scientists.

IT Technical refresh is performed based on established industry practices, routinely on a 3 year cycle for desktops, and 4 years for server systems and communications equipment due to the higher cost. NOAA Research desktop operating systems include Windows, Macintosh, and various distributions of Linux. According to Gartner (Use Processes and Tools to Reduce TCO for PCs, 2005-2006 Update, 13 January 2006), PC hardware and operating system choices are no longer the greatest determinants of PC total cost of ownership (TCO). The implementation of policies, best practices and processes offers the main opportunities for enterprises to reduce the TCO of their PC installed base across its life cycle.

Very loosely coupled clusters can be created by combining together otherwise idle desktop computers in an ad-hoc environment, thus allowing a dual use of certain resources. Such clusters allow researchers to use otherwise "wasted cycles" by combining computer resources that would be idle overnight to tackle specific jobs. In particular, ESRL has been running a loose cluster of 60 Macintosh desktop computers for the past few years which is managed as a desktop system and as a node in a loose cluster.

Environmental modeling applications are processor intensive, and when compute systems are replaced, compute cluster technology is purchased to ensure scalability and load balancing. A compute cluster is a group of loosely coupled computers that work together closely so that in many respects they can be viewed as though they are a single computer. The components of a cluster are commonly, but not always, connected to each other through fast local area networks. Clusters are usually deployed to improve performance and/or availability over that provided by a single computer, while typically being much more cost-effective than single computers of comparable speed or availability. Cost efficiencies can be achieved because a cluster does not have to be replaced when more processor power is needed – instead, it can grow by acquiring additional processors.

1.2 Performance Measures

NOAA Research has an indirect but important role that can potentially impact lives and property. Below are selective highlights from FY2009 project accomplishments that demonstrate performance results to the citizens of the US. These measures align with the "Customer Results Measurement Area" of the Performance Reference Model developed by the Federal Enterprise Architecture Program Management Office (FEA-PMO). Table 1 summarizes the performance measures.

Table 1: Customer Results Performance Measure

Measurement Area	Indicator	[Reporting Year – 1] Baseline	[Reporting Year] Actual Result	Comments
Customer Requirements	Climate Observation and Analysis: Integrated Ocean Observing System (IOOS) Implemented	59%	60%	

NOAA research and development is unique within the federal government. No other agency investigates the Earth system from the bottom of the ocean to the top reaches of the atmosphere. NOAA researchers are tackling some of our Nation's most pressing challenges, including global climate change, improving weather and air quality forecasts and warnings, understanding the complexities of the oceans, and natural resource management. Here are some prime examples of NOAA Research (Scientific Computing Support) accomplishments in 2009.

NOAA Scientists Successfully Test Robotic Hurricane Aircraft

NOAA's Atlantic Oceanographic and Meteorological Laboratory and Aircraft Operation Center in Miami, FL, in partnership with BAE Systems and the Navy, completed the first flight of an unmanned aircraft system (UAS) from a NOAA manned aircraft. The Coyote, a mini-unmanned aircraft, launched from a WP-3D hurricane reconnaissance aircraft over the Gulf of Mexico. BAE Systems currently is developing the Coyote for the Navy, and also adapting it for hurricane research data collection by NOAA scientists. The UAS can remain airborne for up to 3 hours, and if appropriate terrain is within the vehicle's flight range, the Coyote can land and recover autonomously. This effort advances NOAA research by allowing scientists to sample and analyze the low-level hurricane environment, which is too dangerous for manned aircraft.

MADIS Reaches Milestone in its Transition to Operations

The Meteorological Assimilation Data Ingest System (MADIS) met a major milestone in transitioning real-time capabilities to operations when its data receiving and distribution hardware and software were installed at the National Weather Service (NWS) Telecommunications Operations Center (TOC). MADIS expands the amount of data available to weather forecasters by integrating observations from other agencies and private networks with NOAA observations, making them easily accessible and usable to the greater meteorological community.

Initial operating capability for the system is scheduled for 2010. The Earth System Research Laboratory (ESRL) in Boulder, CO, is NOAA's primary MADIS research and development organization, and will host a research-to-operations test environment facility. MADIS has been one of NOAA's highest priority research-to-operations transition projects for several years, with plans for implementing MADIS real-time capabilities at the NWS and transferring existing MADIS datasets and future archival responsibilities to the National Environmental Satellite, Data, and Information Service's National Climatic Data Center.

NOAA Lab Successfully Tests Data-pod Technology

The Atlantic Oceanographic and Meteorological Laboratory (AOML) in Miami, FL, completed a successful proof-of-concept field-test of a new data-pod data retrieval system aboard the R/V F. G. Walton Smith in the Straits of Florida. The new data retrieval system, known as the Adaptable Bottom Instrument Information Shuttle System (ABIISS), was developed by AOML engineers. Once fully operational, this system will allow all kinds of scientific instruments anchored on the ocean bottom to send data from the ocean floor on a programmable schedule using data pods. These pods will float up to the sea surface and transmit data back to land via satellite. The system may save significant amounts of financial and personnel resources by reducing the amount of ship time needed to support and maintain ocean time series measurement sites.

Geo-Targeted Alerting System Installed at First Pilot Sites

The Geo-Targeted Alerting System (GTAS) developed by NOAA's Earth System Research Laboratory (ESRL) in Boulder, CO, was installed at pilot sites in the Dallas/Fort Worth area. GTAS uses the Hybrid Single Particle Lagrangian Integrated Trajectory (HySPLIT) dispersion model, developed by NOAA's Air Resources Laboratory in Silver Spring, MD, to provide emergency managers and forecasters the ability to assess quickly and provide more accurate and timely response and mitigation plans to the public following severe weather events or toxic plumes resulting from chemical spills, fire, terrorist attacks, volcanic eruption, and wild fires. GTAS integrates the latest advances in toxic plume and mesoscale weather modeling into a weather/societal impact display and dissemination system tailored for National Weather Service forecasters and state/local emergency managers. The system's developers trained local forecasters and emergency managers on GTAS capabilities, which allow forecasters to collaborate with emergency managers over the internet to more accurately and quickly define societal impact and disseminate the information to the public.

NOAA and Exploratorium Form Partnership

To increase public engagement, NOAA and the Exploratorium, a premier San Francisco-based museum, announced a five-year partnership to bring cutting edge climate, weather, and ocean science to the public. Collaborating with NOAA scientists, the Exploratorium will develop interactive experiences to help explain and illustrate dynamic scientific discoveries. Known as a leader in hands-on informal education, the Exploratorium will take public audiences on an ocean journey from surface to bottom in real-time as if they were aboard the NOAA Ship Okeanos Explorer, a high tech research vessel. Additional Exploratorium-developed interactive experiences for the public that include NOAA's ocean, weather, and climate science and research will engage the public on some of the most critical environmental science issues of the day. The Exploratorium will create an online and museum presence for the Okeanos Explorer that will include ship blogs, video and audio clips of discoveries, tracking in Google Earth, and live streaming high-definition video from the ship. Future projects may include hands-on exhibits and interactive Web sites that inspire and inform the public about phenomena such as tsunamis, El Niño, and local and global fisheries issues with a particular focus on climate change.

New Methane Vent Discovered in Gulf of Mexico

In July, 2009, a mass spectrometer mounted on the Eagle Ray autonomous underwater vehicle (AUV) detected a new methane vent in the Gulf of Mexico at the Mississippi Canyon (MC) 118 site during a National Institute for Undersea Science and Technology project funded by NOAA's Office of Ocean Exploration and Research. This marked the first time a mass spectrometer was successfully used for remote science and chemical mapping on an AUV. The vent, which may coincide with subsurface geologic faults, was found in an area of seafloor known to contain methane hydrates. The discovery of a new vent brings scientists closer to understanding what triggers methane hydrates to become methane gas. The vent site, located 100 miles south of Pascagoula, Mississippi, is an underwater natural laboratory where scientists investigate how methane hydrates and vents form, function, and affect each other and the surrounding chemosynthetic ecosystem. Scientists need to understand how and why methane hydrates turn into methane gas, since the release of methane, a powerful greenhouse gas, could greatly affect climate.

NOAA Scientists Earn Presidential Early Career Awards

Dr. Yi Ming of NOAA's Geophysical Fluid Dynamics Laboratory and Drs. Michael C. Coniglio and Pamela L. Heinselman of NOAA's National Severe Storms Laboratory received the Presidential Early Career Award for Scientists and Engineers. This White House honor is bestowed on exceptional young federal scientists and engineers whose work advances the science and mission of their agencies. Dr. Ming was recognized for "his outstanding record of innovative investigations on aerosols, their interaction with clouds, and their effect on climate and human health, using both climate modeling and observations." Dr. Coniglio was recognized "for significant advances in the understanding of dam aging straight-line windstorms, the development of novel techniques that have improved forecasts of these severe weather events, and the mentoring of students." Dr. Heinselman was recognized "for significant advances in the collection and use of phased array radar data for improved understanding of the physical processes that produce hazardous weather and the mentoring of students."

NOAA Scientists Find Tsunami "Shadow" Visible from Space

For the first time, scientists with NOAA's Earth System Research Laboratory and the Cooperative Institute for Research in Environmental Sciences in Boulder, CO, have demonstrated that tsunamis in the open ocean can change sea surface texture in a way that can be measured by satellite -borne radars. The finding could one day help save lives through improved detection and forecasting of tsunami intensity and direction at the ocean surface. Large tsunamis crossing the open ocean stir up and darken the surface waters along the leading edge of the wave, according to the study. The rougher water forms a long, shadow-like strip parallel to the wave and proportional to the strength of the tsunami. That shadow can be measured by orbiting radars and may one day help scientists improve early warning systems. This research challenges the traditional understanding that tsunamis are too subtle in the open ocean to be seen at the surface. The journal Natural Hazards and Earth System Sciences published the research online.

VORTEX2 Tornado Field Experiment was Largest in History

The National Severe Storms Laboratory (NSSL) in Norman, OK, and numerous research partners conducted the first phase of the Verification of the Origins of Rotation in Tornadoes Experiment – 2 (VORTEX2), the largest tornado field experiment in history. From May 10, 2009 through June 13, 2009, nearly 100 scientists, students, and staff took part in the experiment. VORTEX2 focused on gathering data to answer detailed questions about how, when, and why tornadoes form. VORTEX2 will give researchers a better understanding of tornadoes and should help increase warning time for those in the path of these deadly storms. VORTEX2 research vehicles each logged over 10,000 miles visiting nine states (Oklahoma, Texas, Colorado, Kansas, Missouri, Wyoming, Nebraska, South Dakota, and Iowa). NSSL used VORTEX2 as an opportunity to reach out to the public through social networking, including Facebook and Twitter.

NOAA Selects New Cooperative Institutes

NOAA's Office of Oceanic and Atmospheric Research and National Marine Fisheries Service selected a consortium of five universities for the new Cooperative Institute for North Atlantic Region. This new cooperative institute will conduct ocean and climate research to better understand the correlation between climate change and variability, fishing practices and fish populations, and to develop an integrated capability to research emerging issues from an ecosystem perspective. Another new cooperative institute, the Harbor Branch Consortium, will focus on ocean exploration, research, and technology development for the U.S. East Coast. The consortium is led by the Harbor Branch Oceanographic Institute at Florida Atlantic University in Fort Pierce, FL, and co-managed by the University of North Carolina Wilmington. Limited partners are SRI International of St. Petersburg, FL, and the University of Miami. The new institute will conduct research under three main themes: development of advanced underwater technologies, exploration and research of frontier regions of the eastern continental shelf and beyond, and improved understanding of deep and shallow coral ecosystems.

NOAA Expedition Hears Endangered North Atlantic Right Whales off Greenland

A team of scientists funded by NOAA's Office of Ocean Exploration and Research recorded the distinctive calls of endangered North Atlantic right whales in an area where it was believed that the historic resident population was hunted to extinction in the early 20th century. Besides providing a better understanding of the whales, the discovery has implications for future shipping in the region. Scientists from NOAA's Pacific Marine Environmental Laboratory in Seattle, WA, NOAA's National Marine Mammal Laboratory, and Oregon State University deployed "listening" hydrophones to continuously record sounds for a year in the Cape Farewell Ground, an area off the southern tip of Greenland. Knowing that the whales are in the area is important, as continued ice melt likely will lead to increased shipping in the region.

Network of Research Buoys in Indian Ocean to Improve Monsoon Prediction

A new array of moored buoys in the Indian Ocean will provide critical climate and ocean data to help scientists predict the dramatic variations between seasonal monsoon rains and droughts. The buoy data will provide much-needed information to advance understanding of the oceanic and atmospheric processes that govern the monsoons, and should ultimately help improve computer models for seasonal forecasting to benefit farming communities and other weather-sensitive sectors of society. NOAA's Pacific Marine Environmental Laboratory in Seattle, Washington, along with international partners,

established the array to collect important oceanographic and meteorological data from the Indian Ocean, the most poorly observed and least well understood of the three tropical oceans.

NOAA Dives into the Ocean with Google Earth

Google unveiled Ocean in Google Earth, a new way for online explorers to dive into the ocean's depths. NOAA contributed and will continue to contribute a variety of data and imagery to the project. Office of Ocean Exploration and Research expeditions, such as a trip to the submerged wreck of the Titanic, and information and ocean current maps demonstrating marine debris movement from NOAA's Marine Debris Program are included. NOAA contributions include data from the National Data Buoy Center, seabed maps of U.S. coastal waters, information on marine protected areas such as the 13 U.S. National Marine Sanctuaries and one Marine National Monument, high resolution seabed maps, and photography. NOAA's Great Lakes Environmental Research Laboratory in Ann Arbor, MI, supplied Google Earth detailed three-dimensional maps of Lakes Huron, Ontario, Erie, Superior, and Michigan. Visitors to the Great Lakes feature can explore the canyons and sandbars in eastern Lake Superior, the Lake Michigan mid-lake reef complex, and the old river channel – now underwater – that once connected Lakes Michigan and Huron at the Straits of Mackinac.

** See Appendix C for more information on Google Ocean*

Ice-Free Arctic Summers Likely Sooner Than Expected

Arctic summers may be ice-free in as few as 30 years, not at the end of the century as previously thought, based on research conducted by NOAA's Pacific Marine Environmental Laboratory in Seattle, WA. The updated forecast is the result of a new analysis of computer models coupled with the most recent summer ice measurements. Researchers analyzed projections from six computer models, including three with sophisticated sea ice dynamics. Those data were then combined with observations of summer sea ice loss in 2007 and 2008. The area covered by summer sea ice is expected to decline from its current 4.6 million square kilometers (about 1.8 million square miles) to about 1 million square kilometers (about 390,000 square miles) – a loss approximately two-fifths the size of the continental United States. Much of the sea ice would remain in the area north of Canada and Greenland and decrease between Alaska and Russia in the Pacific Arctic.

Atmospheric 'Sunshade' Could Reduce Solar Power Generation

The concept of delaying global warming by adding particles into the upper atmosphere to cool the climate could unintentionally reduce peak electricity generated by large solar power plants by as much as one-fifth, according to a 2009 NOAA study. Scientists from NOAA's Earth System Research Laboratory in Boulder, CO, indicated that injecting particles into the stratosphere could have unintended consequences for one alternative energy source expected to play a role in the transition away from fossil fuels. To counteract the effect of climate change, some geo-engineering proposals are designed to slow global warming by shading the Earth from sunlight. Among the ideas being explored is injecting small particles into the upper atmosphere to produce a climate cooling similar to that of large volcanic eruptions, such as Mt. Pinatubo's in 1991. Airborne sulfur hovering in the stratosphere cooled the Earth for about two years following that eruption. The study found that particles in the stratosphere reduce the amount and change the nature of the sunlight that strikes the Earth. Though a fraction of the incoming sunlight bounces back to space (the cooling effect), a much larger amount becomes diffuse, or scattered, light. The findings appear in Environmental Science and Technology.

New Deep-Sea Coral Discovered on NOAA-Supported Mission

Scientists identified seven new species of bamboo coral discovered on a NOAA Office of Ocean Exploration and Research-funded mission in the deep waters of the Papahānaumokuākea Marine National Monument off the coast of Hawaii. Six of these species may represent entirely new genera, a remarkable feat given the broad classification a genus represents. A genus is a major category in the classification of organisms, ranking above a species and below a family. Scientists expect to identify more new species as analysis of samples continues. The discoveries are important because deep-sea corals support diverse seafloor ecosystems and also because these corals may be among the first marine organisms to be affected by ocean acidification. Ocean acidification is a change in ocean chemistry due to absorption of excess atmospheric carbon dioxide. Researchers have seen a dverse changes in marine life with calcium-carbonate shells, such as corals, because of acidified ocean water. Deep-sea bamboo

corals also produce growth rings much as trees do, and can provide a much-needed view of how deep ocean conditions change through time.

NOAA Research Employee Named to Federal 100

Eric Hackathorn of NOAA's Earth System Research Laboratory in Boulder, CO, was named one of the Federal 100, a Federal Computer Week award. The Federal 100 recognizes individuals from government, industry, and academia who significantly influence how the federal government buys, uses, or manages information technology. The winners are recognized for their risk-taking, vision, and pioneering spirit in the federal information technology community. Hackathorn was selected for his pioneering work creating a NOAA presence on the live, virtual world, Second Life. The NOAA site often is highlighted as the prime example of federal government content on Second Life. NOAA's island offers visitors an interactive and compelling experience where visitors can experience a tsunami, interact with a real-time weather map, fly in an airplane into the eye of a hurricane or take a ride in a weather balloon. NOAA's islands receive thousands of visitors every week, 40 percent of which had not heard of NOAA before visiting the islands. NOAA's presence on Second Life is an innovative way to reach a whole new audience by allowing them to experience the planet through reality-based virtual adventures.

Sea Grant Enables Consumers to Trace Fish History

NOAA's Oregon Sea Grant Program, Oregon State University, the Community Seafood Initiative, and Oregon commercial fishermen have developed a new project called Pacific Fish Trax, which enables consumers to trace the history of their fish from ocean to market. Through this program, consumers are shown the history of a fish, from the local fisherman who caught the fish, to the boat where it was caught, and the processor who packaged it, all from a scan of a bar-code at specially designed kiosks. Once home, consumers can access the Pacific Fish Trax website that shows where the fish was caught, its temperature history, and other information. Maps and graphics reveal ocean locations, conditions and even the contour of the seafloor. Pacific Fish Trax is a scientific venture and public outreach effort that will promote the state's commercial fishing industry and strengthen wild fish runs.

Studies Reveal Growing Importance of CFC-Alternatives in Climate Warming

Some of the substances that help avert destruction of the ozone layer could contribute increasingly to climate warming, according to scientists from NOAA's Earth System Research Laboratory (ESRL) in Boulder, CO. Two studies published by ESRL scientists examined the role of hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs) on climate and ozone. HFCs and HCFCs are both chemicals that have been used as alternatives to ozone-depleting compounds such as chlorofluorocarbons (CFCs), which were phased out of production by the 1989 Montreal Protocol. In September 2007, parties to the Montreal Protocol agreed to more stringent restrictions on future HCFC production in light of their contributions to ozone depletion and climate change.

In one study, published in the Proceedings of the National Academy of Sciences, the authors took a fresh look at how the global use of hydrofluorocarbons (HFCs) is expected to grow in coming decades. HFCs replaced CFCs in applications such as refrigeration, air conditioning, and the production of insulating foams. Using updated usage estimates and projecting to the year 2050, they found that HFCs — especially from developing countries — will become an increasingly larger factor in future climate warming, with a climate change contribution that is 7 to 12 percent of that from carbon dioxide emissions. Today it is less than 1 percent.

In the second study, published in Geophysical Research Letters, ESRL researchers showed that the atmospheric abundances of HCFCs have increased at an accel erated rate in recent years. Through signals extracted from the measurement data and from an assessment of global production figures, the researchers were able to attribute increases in the three most abundant HCFCs to accelerated use in developing countries. Of all the ozone-depleting substances regulated by the Montreal Protocol, only HCFCs continue to increase in the global atmosphere. This is primarily because use of these chemicals is still allowed.

Maritime Shipping Makes Hefty Contribution to Harmful Air Pollution

Globally, commercial ships emit almost half as much particulate matter pollutants into the air as the total amount released by the world's cars, according to a study led by the Earth System Research Laboratory and the Cooperative Institute for Research in Environmental Sciences at the University of Colorado at Boulder. Ship pollutants affect local air quality and the health of people living along coastlines. The findings appeared online in the Journal of Geophysical Research. The study is the first to provide a global estimate of maritime shipping's total contribution to air particle pollution based on direct measurements of emissions. The authors estimate that globally, ships emit 0.9 teragrams, or about 2.2 million pounds, of particle pollution each year. Since more than 70 percent of shipping traffic takes place within 250 miles of the coastline, this is a significant health concern for coastal communities.

Lake Michigan Fish Populations Threatened by Decline of Tiny Creatur e

NOAA scientists indicate that the quick decline of a tiny shrimp-like species, known scientifically as Diporeia, is related to the aggressive population growth of non-native quagga mussels in the Great Lakes. As invasive mussel numbers increase, food so urces for Diporeia and many aquatic species have steadily and unilaterally declined, which is having an adverse affect on Lake Michigan fish populations that depend on the Diporeia as a food source. A recent research study from the Great Lakes Environment al Research Laboratory (GLERL) in Ann Arbor, MI, published in Freshwater Biology documents the recent decline of Diporeia and the explosive growth of quagga mussels in Lake Michigan. Over the past five years quagga mussels have displaced native Diporeia a s the dominant bottom dwelling organism, leading to a major disruption in the lake's food web. GLERL scientists project impacts on fish populations will continue and become more pronounced as quagga mussels further spread to all depths occupied by the dwindling Diporeia.

New Study Shows Some Climate Change Impacts Largely Irreversible

A study led by NOAA's Earth System Research Laboratory in Boulder, CO, published in the Proceedings of the National Academy of Sciences shows that changes in surface tem perature, rainfall, and sea level are largely irreversible for more than 1,000 years after carbon dioxide (CO_2) emissions are completely stopped. If atmospheric CO_2 concentrations rise to 450-600 parts per million from the current value of 385 parts per million, the results would include persistent decreases in rainfall comparable to the 1930s North American "Dust Bowl" in zones including southern Europe, northern Africa, southwestern North America, southern Africa, and western Australia. The scientists e mphasized that increases in CO_2 that occur in this century essentially "lock in" the sea level rise that would slowly follow over the next 1000 years. The authors found that the irreversible global average sea level rise by the year 3000 would be at least 0.4 – 1.0 meters if CO_2 peaks at 600 parts per million, and about double that amount if CO_2 peaks at 1000 parts per million. Support for these findings was robust enough to quantify some irreversible climate impacts, including rainfall changes in certain key regions, and global sea level rise. This study demonstrates that some climate change impacts taking place due to increases in atmospheric CO_2 concentrations are largely irreversible, and will have large consequences for agriculture, ecosystems, and coastal environments.

New NOAA Great Lakes Laboratory Opens

The Great Lakes Environmental Research Laboratory moved into a new facility in Pittsfield Township, MI. The laboratory has focused on Great Lakes issues since 1974 and is a leader in research to pics such as invasive species, lake levels, and the use of biofuels for its research ships. The new 40,225 square -feet facility has modern wet and dry laboratories, conference facilities, a library, marine instrumentation shop, and office space to accommo date about 120 federal and cooperative institute employees. Office and laboratory space also is provided to partner organizations, including Michigan Sea Grant Extension, the Cooperative Institute for Limnology and Ecosystem Research, the International As sociation for Great Lakes Research, the NOAA National Center of Excellence for Great Lakes and Human Health, NOAA National Center for Research on Aquatic Invasive Species, and the Great Lakes Habitat Restoration Office.

Research Meteorologist Wins First NOAA Science Communicator Award

Keith Dixon, a NOAA scientist who demonstrates both skill and enthusiasm for communicating to the public about climate research and climate change, was the recipient of the first Dr. Daniel L. Albritton Outstanding Science Communicator Award. Dixon, a research meteorologist and climate modeler at NOAA's Geophysical Fluid Dynamics Laboratory in Princeton, NJ, was recognized for his "rare talent and passion for explaining the complexities of climate science in a clear, compelling, and often entertaining style." The award is named for Dr. Daniel L. Albritton, who was the director of NOAA's Aeronomy Laboratory, which was consolidated with five other laboratories into what is now the Earth System Research Laboratory in Boulder, CO. Albritton, now retired, used illustrations and easily understood language to explain complex concepts to a variety of audiences, including U.S. Cabinet Secretaries, members of Congress, and the general public.

NOAA's GFDL Hurricane Forecast Model Achieves High Accuracy in 2008 Season

The hurricane forecast model from NOAA's Geophysical Fluid Dynamics Laboratory (GFDL) in Princeton, NJ, performed extremely well again in the 2008 hurricane season. Sixteen named storms formed this season, based on an operational estimate by NOAA's National Hurricane Center (NHC). The storms included eight hurricanes, five of which were major hurricanes at Category 3 strength or higher. In both the East Pacific and Atlantic basins, the GFDL model had low track forecast errors. For example, the model errors in the Atlantic basin in the critical 48-hour and 72-hour time period were about 13 and eight percent, respectively. This corresponded to a slightly greater than 60 percent reduction in track errors. The excellent guidance of the GFDL model was an important contributor to NHC performance in the very active 2008 Atlantic season.

New Study Details Ocean Acidification in the Caribbean

The potential for coral growth in the Caribbean region is dramatically changing due to ocean acidification. A new study, which confirms significant ocean acidification across much of the Caribbean and Gulf of Mexico, reports strong natural variations in ocean chemistry in some parts of the Caribbean that could affect the way reefs respond to future ocean acidification. Such short-term variability often has been underappreciated and may prove an important consideration when predicting the long-term impacts of ocean acidification to coral reefs.

Conducted by scientists from NOAA's Atlantic Oceanographic and Meteorological Laboratory and the University of Miami's Rosenstiel School of Marine and Atmospheric Science, the study was published in the October 31, 2008, issue of the Journal of Geophysical Research – Oceans. Previous NOAA studies have shown that a quarter of the carbon dioxide that humans place in the atmosphere each year ends up dissolved into the ocean. The result is the ocean becomes more acidic, making it harder for corals, clams, oysters, and other marine life to build skeletons or shells. A number of recent studies demonstrate that ocean acidification is likely to harm coral reefs by slowing coral growth and making reefs more vulnerable to erosion and storms.

2008 Sees Fifth Largest Ozone Hole on Record

The ozone hole over Antarctica, which fluctuates in response to temperature and sunlight, grew to the size of North America in a one-day maximum in September 2008 – the fifth largest on record, since NOAA satellite records began in 1979. The primary cause of the ozone hole is human-produced compounds called chlorofluorocarbons (CFC), which release ozone-destroying chemicals into the atmosphere. Earth's protective ozone layer acts like a giant umbrella, blocking the sun's ultraviolet-B rays. Though banned for the past 21 years to reduce harmful build up, CFCs take many decades to dissipate from the atmosphere. According to NOAA scientists at the Earth System Research Laboratory in Boulder, CO, ozone-depleting chemicals, atmospheric greenhouse gases, and colder than average temperatures in the stratosphere may have played a part in the ozone hole's development in 2008.

Annual Arctic Report Card Shows Stronger Effects of Warming

Temperature increases, a near-record loss of summer sea ice, and melting of surface ice in Greenland are among some of the evidence of continued warming in the Arctic, according to an annual review of conditions in the Arctic issued by NOAA and its university, agency, and international partners. The Arctic is a sensitive system and often reflects changes in relatively fast and dramatic ways. The year 2007 was the warmest on record for the Arctic, continuing a general Arctic-wide warming trend that began in the

mid-1960s. The Arctic Report Card, an annual product introduced by NOAA's Climate Program Office in 2006, and led by NOAA's Pacific Marine Environmental Laboratory in Seattle, WA, establishes a baseline of conditions in that region in the 21st century and provides a way of monitoring the often quickly changing conditions. It is updated annually in October and tracks the Arctic atmosphere, sea ice, biology, ocean, land and Greenland.

Sea Grant Reduces Trawler Fuel Consumption and Saves Jobs

NOAA's Texas Sea Grant program has facilitated testing of new fuel-efficient trawl gear by 15 producers throughout the Gulf and South Atlantic states resulting in reported fuel savings that range from 20 to 39 percent. For a median trawler, expected annual fuel savings are approximately 19,000 gallons per season, which equates to a savings of approximately $67,000 (assuming $3.50 per gallon for industrial diesel). In Brownsville, TX, where more than 85 percent of the vessels have adopted the experimental gear, fuel savings are estimated at 2.5 million gallons, valued at $8.75 million in 2008. These fuel savings allowed more boats to operate last year, saving an estimated 200 jobs.

Sea Grant Preserves Working Waterfronts and Coastal Access

NOAA's North Carolina Sea Grant Program, through its Coastal Resources Law, Planning, and Policy Center, provided critical research information on the status of waterfront seafood processing facilities, and details on land use, zoning, and easements to the North Carolina Waterfront Access Study Committee. Ultimately, the North Carolina General Assembly approved several of the committee's recommendations, including a change in the tax designation for working waterfronts and establishment of a new $20 million state fund for projects to maintain working waterfronts and/or provide greater access for commercial and recreational vessels. Many other Sea Grant programs are pioneering research on working waterfronts and coastal access issues. Considerable policy and legal research has lead to legislation at the state and federal levels to preserve working waterfronts and protect community access to the water, which has helped retain and create jobs in coastal communities.

Sea Grant Builds Sustainable Coastal Community

NOAA's Louisiana Sea Grant Program has assisted in the recovery of the shrimping industry and associated economic benefits in Delcambre, LA, that were wiped out by a 10-foot storm surge from Hurricane Rita. The surge caused $9.9 million worth of damages to the waterfront and shrimping fleet of this coastal village. As requested by Delcambre Town/Ports Steering Committee, Louisiana Sea Grant provided funding to Louisiana State University's (LSU) landscape architecture program. LSU senior landscape architecture students developed a conceptual redevelopment plan for the waterfront and surrounding area Architecture and design students from the University of Louisiana's Community Design Workshop developed additional design concepts with additional Sea Grant funding, including a public marina, open-air markets, waterfront residential areas, boardwalks, and a hotel. In 2008, Delcambre leveraged the Sea Grant-sponsored plans and acquired $2.6 million in grants from the Louisiana Recovery Authority for waterfront redevelopment and fleet reconstruction. In October 2009, local voters approved a property tax that will generate $300,000 annually for continued waterfront revitalization, which could be leveraged into as much as $3 million in loans and additional matching funds and grants. The success of the partnership between Sea Grant and LSU is evidenced by the willingness of town residents to be assessed additional taxes in support of these Sea grant sponsored plans.

ARL Monitors Atmospheric Mercury in Western Pennsylvania

In collaboration with the Pennsylvania Department of Environmental Protection and the National Park Service, NOAA's Air Resources Laboratory (ARL) has begun monitoring ambient air concentrations of mercury at the Allegheny Portage Railroad National Historic Site in Cambria County, PA. Power plants in Pennsylvania annually emit more than 3.26 tons of mercury per year, nearly 80 percent of all the mercury emissions in Pennsylvania. The state ranks second only to Texas in total mercury emissions. Atmospheric mercury is the primary source of new mercury entering watersheds, and Pennsylvania has more than 80 rivers and lakes on the U.S. EPA list of mercury-impaired waters, including the Susquehanna, Delaware, and Allegheny Rivers. In 2003, the Centers for Disease Control and Prevention reported that one in 12 U.S. women of childbearing age have unsafe mercury levels that result in 400,000 infants born every year with mercury concentrations high enough to potentially lead to IQ loss. The impacts on education systems and national productivity are estimated at $8 billion per year. Human

exposure to mercury is primarily from the consumption of contaminated fish and other aquatic organisms. ARL's monitoring will be used to assess the effectiveness of Pennsylvania's mercury emissions controls.

NOAA Study in Washington DC Area to Help Understand and Forecast Urban Air Quality During a week-long investigation in September 2009, scientists from NOAA's Air Resources Laboratory (ARL) and National Centers for Environmental Prediction collaborated to investigate the evolution of the urban daytime Planetary Boundary Layer (PBL) in the Washington, DC, area. To accomplish this, ARL deployed portable upper air measurement systems at Howard University and RFK Stadium in Washington, D.C. The PBL is the mixed layer of the atmosphere closest to the ground and influenced by many factors, including local topographical features, surface heating, surface type, large-scale weather patterns, and cloud cover. The goal of this study is to develop an urban meteorological evaluation database to investigate the daytime evolution and spatial variability of the urban atmospheric boundary layer mixing height. The mixed layer height is a key atmospheric parameter for all models intended to predict conditions at the surface. It is especially important for atmospheric dispersion and air quality models since the PBL height controls the depth of the atmosphere over which emissions will be diluted. A large proportion of the U.S. population lives within or near an urban environment. Accurate assessment of the dynamics of the PBL at finer scales will improve air quality forecasts and the Nation's ability to assess the effects of a toxic or hazardous materials release, should one occur.

2.0 Strategic and Business Results

2.1 NOAA Research Helps to Achieve Strategic Goals

Selected Research accomplishments that demonstrate NOAA Research's ability to help achieve NOAA Strategic Goals, across all goals:

- Climate Goal – Climate Observation and Monitoring (CL-COM)
  - Capability: Climate Systems Observations (OBS)
    - Atmosphere: USCRN: Design/install Marshall test bed, Boulder, CO study automated snow depth sensors, intercompare precip gauge for snow/wind events; Improved data access, updated performance monitoring, developing station Normals, intercomparing data to nearby other station and satellite data. Begin installing soil sensors (NIDIS); Alaska-Conduct site surveys, Install 2 stations (Aug). USHCN-M: Site Surveys/Selections continue, install 6 prototype sites SW region; Implemented web-based metadata documentation/access capability; Complete review AK & HI HCN sites, add to USHCN list. GCOS: No upgrade to GSN or GUAN sites. Participated in international activities-GCOS Reference Upper Air Network (GRUAN). U.S. Baseline Surface Radiation Network (US BSRN): Sustain SURFRAD & NOAA STAR and U.S. GEWEX stations (21); Insufficient O&M $-closing Black Hills, SD GEWEX site.
    - Oceans: GOOS-continue build out to 100%; Sustaining % a challenge. Added TAO buoys in Indian Ocean (RAMA). TAO: Begin Refresh; Delay transition Res to Ops.
    - Arctic: Overall completion held to 11%. Joint US/Russian-Monitor physical/biological system Bering Strait, Chukchi Sea, and Pacific Region of Arctic; Examine state of sea ice; Install CRN at Tiksi, Russia (Aug); Conduct census of marine life north of Alaska & Chukotka; Build physical/biological data base to detect marine ecosystem response; Mooring recovery and deployment in the Bering Strait; US, Russia, and S. Korea scientists take physical/biological samples across Chukchi Shelf & sea ice region; Traverse Nome to Vladivostok, deploy 6 Argo floats, western Bering Sea.
    - Climate Forcings: Sustain existing capability. Unable to meet GPRA target. Expand air flask obs in Caspian Sea/central Siberia (GHG/permafrost); add instruments to Summit Greenland.
  - Capability: Data Management and Information (DMI)

- Contribute to NCS draft plan/strategy led by NOAA. SDS: With NASA & OSTP complete CDR/CIR planning-FY10 funding start. Service Oriented Architecture (SOA): Work with USGEO to develop policy guidance for all agencies. ARL evaluate: Observed climatology & trends in planetary boundary layer, effects ENSO on Stratospheric temps, and upper air (U/A) temp data to reduce uncertainties in trends. CDRs: Award grants & contracts; Begin developing CDRs and CIRs; Collaborate with NASA & academic community. Satellites IV&V: With NESDIS STAR develop satellite/in-situ reference obs inter-comparison capability. CDMP: Continue rescue-migrate data. NEXRAD: Develop other next generation interactive viewer/data exporter & visualization browse/display tools & prototype system for dual polarized radar. SOA: Improve capability to meet customer demands for data product & info interoperability, linking data sources, analysis, & services into comprehensive processing/delivery capability, i.e., Blended SST and Integrated Surface Data (ISD). CLASS: Transition components to operational status; CLASS Ops & Planning Board (COPB) established to manage operational components (Directors NCDC, NGDC, NODC).

- Climate Goal – Climate Research and Modeling (CL-CRM)

  UCP adjusted to the FY09 President's budget by (1) maximizing efforts to analyze the results of the FY08 intensive field campaigns (ARCPAC and ICEALOT) on the role of absorbing aerosol on the Arctic, (2) delaying further development of much needed water vapor instrumentation to FY10 and beyond; (3) using data from Air Quality studies of FY06 to extract some limited information on tropospheric ozone; (4) optimizing aerosol vertical profile measurements at just one location and (5) continuing at a reduced level the critical CO2 studies for addressing CRM and ocean acidification issues. In addition, UCP scientists evaluated the climate friendliness of a substitute for methyl bromide, a very powerful ozone depleting substance that is used for fumigation.
  New modeling capabilities complete in FY09 include: coupled models using new ocean codes that integrate different vertical co-ordinates; a new land model (LM3) with new hydrology and interactive ecosystems; coupled atmosphere/land model (AM3/LM3) with interactive aerosols; and coupled ocean/sea ice model. Also complete is a new ocean model code base (GOLD) and a high spectral resolution radiation model for use in the next generation ESM. Downscaling studies combining the GFDL Hurricane Prediction System with regional and global climate simulations generated new projections of the influence of global warming on hurricane intensity, and key contributions to a new WMO assessment on climate change and hurricanes were provided. Initial decadal prediction experiments were conducted for the IPCC AR5 report.

  The CRM grants program Climate Prediction Program for the Americas (CPPA) contributed to a successful VOCALS-REx Field Experiment in Chile during Oct.-Nov.2008 with multiple platforms including NOAA/Ron Brown.

  Improved climate products under development are: an extension of CPC Unified Gauge Analysis of Daily Precipitation over CONUS 1948-1978; a North American Monsoon Forecast Forum product suite and webpage; experimental objective temperature and salinity analysis for deep oceans based on XBT and ARGO profiles to provide independent validation for GODAS and to monitor long-term changes in the ocean; experimental real time monitoring index for oceanic Kelvin waves in support of ENSO prediction; a CLIMAS Forecast Evaluation Tool (FET); incorporation of the hourly UV Index forecasts into the NWS Hourly Weather Forecast Graph page; implementation of ENSO Alert System in CPC Forecast Operations; and drought monitoring and prediction tools over NIDIS pilot study areas. CPC has also initiated assessment of the GFDL Coupled Model as a potential member of a National Multi-Model Ensemble
  A 121-year-long (1889-2008) climate reanalysis was produced using a version if GFS that includes time varying greenhouse forcing, solar variability, volcanic forcing, and atmospheric aerosols. Experimental attribution assessments of two recent high impact climate events of interest to policy and decision makers were developed.

- Climate Goal – Climate Service Development (CL-CSD)
  Programs within CSD are supporting or directly executing a variety of activities intended to build on the nascent foundation established in FY08 and earlier years to begin to systematically expand understanding of the value of climate information for decision making across several sectors at a variety of temporal and spatial scales, and shape NOAA's understanding of user needs. Efforts continue to be limited to the provision of basic climatologic information and seasonal to inter-annual forecasts (as opposed to longer term projections) for only a few couple key sectors (e.g. water resources and coastal areas). These efforts are building a foundation for future activities that will provide more useful and timely climate service to an increasingly diverse set of end users within NOAA, other federal agencies, and state and local government, and the private sector. As in FY08, particular attention was given to increasing public awareness of the drivers and challenges represented by climate variability and change, utilizing existing NOAA capabilities for provide meaningful projections and forecasts, and develop tools to support more effective use of NOAA provided climate information by decision makers in a slowly expanding but still limited number of sectors and regions (e.g., greater interactions with resource managers, including fisheries and other conservation biologists).

  Specific examples of these activities include, but are not limited to:
  - Develop sector specific synthesis documents, handbooks, and climate information requirements for decision makers (SARP and RISA)
  - Continue work on Coping with Drought (SARP, RISA, TRACS)
  - Regional climate impacts science and stakeholder projects (RISA, NIDIS, RCC, NWS CSD)
  - Workshops to increase communication between the research community and stakeholders (SARP and RISA)
  - Drought monitoring and prediction products to the upper CO basin (CTB, TRACS)
  - Begin field and operational training related to NIDIS (NWS CSD)
  - Enhanced integration of regional programs with applied research and forecasting capabilities (RISA, RCC, NWS HDSC, CTB)
  - Maintain observations and research that contribute to the development, refinement and operational generation of biophysical models and indices for predictions of climate impacts on living marine resources (NPCREP)
  - Continue procurement and begin installation of soil moisture sensors at USCRN sites (NIDIS)
  - Work with partners develop content and populate various data portals (NIDIS, NWS CSD, RCC)
  - Expand Int'l Multi-Model Ensemble prediction system (CTB)
  - Collaborative Transition Projects through annual request for proposals (CTB, TRACS)

2.2 Business Results

2.2.1 Program Management and Controls

At the NOAA level, the NOAA's Program Planning and Integration (PPI) and Programming, Analysis and Evaluation (PA&E) offices provide management oversight from Planning to Programming to Budgeting to Execution (PPBES) using the PPBES process. At the Line Office level, the Climate Program Office provides management oversight for the Climate Goal Programs.

2.2.2 Monitoring Cost, Schedule and Performance

Program funding increases to meet planned Program Initiatives are requested through the NOAA PPBES process. Each PPBES Program capability in the Program Operating Plans (POPs) provides cost, schedule, and performance information.

Quarterly, Quad Charts are prepared for the NOAA Budget Office to track Cost, Schedule, and Performance, and update the NOAA CFO and PA&E on Risks and Issues and mitigation strategies.

Below is a sample from the Observations and Analysis POP submitted in May 2009.

Current Program Resources

	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	TC
CL-COM-DMI Data Management And Information							Attached Documents [0]		
	$0	$53,978	$74,123	$76,133	$77,850	$80,133	$82,123	$74,123	-
FTE	188	188	191	190	190	190	190	190	
NOAA Corps	0	0	0	0	0	0	0	0	
On-site Contractors	189	196	210	211	212	214	215	216	
On-site Associates	0	0	0	1	1	1	1	1	
Competitive Research Program	$0	$6,498	$6,667	$6,667	$6,667	$6,667	$6,667	$6,667	-
Space Environment Center (C)	$0	$0	$0	$0	$0	$0	$0	$0	-
National Climatic Data Center	$0	$0	$0	$0	$0	$0	$0	$0	-
Integrated Environmental Applications & Information Center	$0	$0	$0	$0	$0	$0	$0	$0	-
Archive, Access & Assessment	$0	$25,189	$44,955	$46,955	$48,955	$50,955	$52,955	$44,955	-
GOES Data Archive Project	$0	$0	$0	$0	$0	$0	$0	$0	-
Climate Database Modernization - KY	$0	$1,361	$1,361	$1,361	$1,361	$1,361	$1,361	$1,361	-
Climate Database Modernization - MD	$0	$993	$993	$993	$993	$993	$993	$993	-
Quality Assurance/Quality Control - NC	$0	$275	$275	$275	$2	$275	$275	$275	-
Climate Database Modernization WV	$0	$1,434	$1,434	$1,434	$1,434	$1,434	$1,434	$1,434	-
International Pacific Research Center (U of H)	$0	$0	$0	$0	$0	$0	$0	$0	-
Environmental Data Systems Modernization	$0	$9,301	$9,511	$9,511	$9,511	$9,511	$9,511	$9,511	-
Climate Sensors (IOOS)	$0	$0	$0	$0	$0	$0	$0	$0	-
Climate Satellite Sensor (OOMPS Limb NPP)	$0	$0	$0	$0	$0	$0	$0	$0	-
Comprehensive Large Array Data Stewardship Sys (CLASS)	$0	$6,476	$6,476	$6,486	$6,476	$6,486	$6,476	$6,476	-
Restoration of Climate Sensors - Data Records	$0	$0	$0	$0	$0	$0	$0	$0	-
Climate Data & Information	$0	$2,451	$2,451	$2,451	$2,451	$2,451	$2,451	$2,451	-
Research Supercomputing / CCRI	$0	$0	$0	$0	$0	$0	$0	$0	-
NOAA Research	$20,778	$20,361	$20,284	$21,184	$21,107	$21,348	$21,271	$21,354	
Extramural Research	$3,281	$3,082	$3,280	$3,640	$4,099	$3,798	$4,257	$3,798	
CL-COM-OBS Observations							Attached Documents [0]		
	$0	$89,196	$119,340	$119,340	$119,340	$119,340	$119,340	$119,340	-
FTE	232	232	238	243	250	256	262	268	
NOAA Corps	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	
On-site Contractors	219	213	230	230	228	228	226	226	
On-site Associates	36.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	
Laboratories & Cooperative Institutes	$0	$21,510	$23,069	$23,069	$23,069	$23,069	$23,069	$23,069	-
Univ of AL Huntsville Climate Research	$0	$0	$0	$0	$0	$0	$0	$0	-
Competitive Research Program	$0	$54,330	$70,250	$70,250	$70,250	$70,250	$70,250	$70,250	-
Climate Data & Information	$0	$6,329	$9,829	$9,829	$9,829	$9,829	$9,829	$9,829	-
Local Warnings and Forecasts Base	$0	$4,661	$4,587	$4,587	$4,587	$4,587	$4,587	$4,587	-

TAO and PIRATA Arrays	$0	$0	$0	$0	$0	$0	$0	$0	-
Sustain Cooperative Observer Network	$0	$1,871	$1,871	$1,871	$1,871	$1,871	$1,871	$1,871	-
Climate Sensors (IOOS)	$0	$0	$0	$0	$0	$0	$0	$0	-
Cooperative Observer Network Modernization	$0	$0	$9,734	$9,734	$9,734	$9,734	$9,734	$9,734	-
Cooperative Observer Network Modernization (C)	$0	$495	$0	$0	$0	$0	$0	$0	-
Restoration of Climate Sensors - Data Records	$0	$0	$0	$0	$0	$0	$0	$0	-
NOAA Research	$20,778	$20,316	$20,284	$21,184	$21,107	$21,348	$21,271	$21,354	
Extramural Research	$3,281	$3,322	$3,200	$3,640	$4,099	$3,798	$4,257	$3,798	
Current Program Total	**$0**	**$143,174**	**$193,463**	**$195,473**	**$197,190**	**$199,473**	**$201,463**	**$193,463**	**-**
FTE Total	**420**	**420**	**429**	**433**	**440**	**446**	**452**	**458**	
NOAA Corps Total	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	
On-site Contractor Total	**408**	**409**	**440**	**441**	**440**	**442**	**441**	**442**	
On-site Associate Total	**36.5**	**37.5**	**37.5**	**38.5**	**38.5**	**38.5**	**38.5**	**38.5**	
NOAA Research Total	**$41,556**	**$40,677**	**$40,568**	**$42,368**	**$42,214**	**$42,696**	**$42,542**	**$42,708**	
Extramural Research Total	**$6,562**	**$6,404**	**$6,480**	**$7,280**	**$8,198**	**$7,596**	**$8,514**	**$7,596**	
Description of Research	Develop techniques to improve monitoring/assessing climate change using climate obs and models. Determine optimal number of climates obs to improve model performance. Improve quality of measurements								

Current Program Outputs

	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
CL-COM-DMI Data Management And Information						Attached Documents [0]		
Competitive Research Program								
C2D2: Research Climate Data Sets Transitioned to Operations/Transferred to ARC (Cum Total #)	1	1	2	2	3	3	4	4
C2D2: Climate Data Sets Upgraded/Updated within ARC (Cum Total #)	27	35	43	50	57	64	71	78
C2D2: Climate Extreme Indices providing Socio-economic Impact Info (Cum Total #)	3	3	3	3	3	3	3	3
C2D2: Paleoclimate Reconstructions (Cum Total #)	9	12	15	18	21	24	27	30
Space Environment Center (C)								
National Climatic Data Center								
SDS: Accepted CDRs Undergoing Testing/Validation (Cum Total #)	0	2	8	11	14	17	20	21
Integrated Environmental Applications & Information Center								
Archive, Access & Assessment								
State of the Climate Report - ECVs Assessed/Reported (Cum Total #)	24	25	28	30	34	38	42	42
NOAA Obs Systems under near real time QC/QA Network Performance Monitoring (Cum Total #)	7	7	8	8	9	10	11	12
Safe Storage (Pri & Security Copy) NARA Standards - NCDC only (Cum Total Vol in PBs)	3.5	6.9	18.7	33.3	71.3	156.3	288.3	480.9
GOES Data Archive Project								
Climate Database Modernization - KY								
Climate Database Modernization - MD								
Quality Assurance/Quality Control - NC								
Climate Database Modernization WV								
CDMP: Pages Digitally Scanned/Imaged (Cum Total # -millions)	52.2	52.4	52.6	52.7	52.9	53	53.2	53.3

	CDMP: Records (data) Manually Keyed and On-Line (Cum Total # -millions)	75	78	81	83	86	88	90	93
International Pacific Research Center (U of H)									
Environmental Data Systems Modernization									
	Data/Info Available for On-Line Retieval via WWW (Cum Total Vol in PBs)	2	2.5	4.5	8	16	31	56	96
Climate Sensors (IOOS)									
Climate Satellite Sensor (OOMPS Limb NPP)									
Comprehensive Large Array Data Stewardship Sys (CLASS)									
Restoration of Climate Sensors - Data Records									
Climate Data & Information									
Research Supercomputing / CCRI									
CL-COM-OBS Observations							Attached Documents [0]		
Laboratories & Cooperative Institutes									
	SEBN Reference Stations operational-28 (Cum Total #)	0	0	0	0	0	0	0	0
Univ of AL Huntsville Climate Research									
Competitive Research Program									
	Arctic Ocean System Completed/Sustained (Cum Total %)	11	11	11	11	11	11	11	11
	GOOS: Tide Gauges Installed/Maintained (Cum Total #)	61	61	70	72	72	74	81	84
	GOOS: Tropical Moored Buoys Deployed and Sustained (Cum Total #)	77	77	82	87	87	87	90	90
	GOOS: Ocean Reference Stations Operational (Cum Total #)	22	22	23	24	24	25	25	25
	GOOS: SOOP Annual High Resolution Transects (Cum Total #/yr)	19	19	21	22	22	23	23	23
	GOOS: Ocean Carbon Surveys Conducted (Cum Total #)	10	10	13	15	17	18	18	18
	COAS Stations Operational: Tall Towers, Sfc Sampling, A/C Profiles (Cum Total #)	35	35	35	35	35	35	35	35
	NWS Upper Air (RRS) U.S. sites Dual Capable w/Ref Sonde (Cum Total #)	0	0	0	0	0	0	0	0
Climate Data & Information									
	USCRN (lower 48-CONUS) sites commissioned-114 (Cum Total #)	114	114	114	114	114	114	114	114
	USCRN in Alaska sites commissioned (Cum Total #)	4	8	12	16	20	24	28	29
	GCOS: GSN sites upgraded ~75 (Cum Total #)	0	2	4	6	8	10	12	14
	GCOS: GRUAN sites ~30 upgrade/operational (Cum Total #)	0	1	1	3	4	5	6	7
Local Warnings and Forecasts Base									
TAO and PIRATA Arrays									
	TAO Buoys Refreshed/Deployed (Cum Total #)	0	0	14	23	32	41	59	59
Sustain Cooperative Observer Network									
	Replace F&P (HPD) Paper Tape Recorders with Digital Recorders (Cum Total #)	200	500	850	1,250	1,700	2,200	2,200	2,200
Climate Sensors (IOOS)									
Cooperative Observer Network Modernization									
Cooperative Observer Network Modernization (C)									
	USHCN-M Climate Regions (9) Completed (Cum Total #)	0	0	1	1	1	1	2	2
Restoration of Climate Sensors - Data Records									

2.3 Reviews

OMB PART Reviews

Within the NOAA Research Scientific Support investment, the latest OMB PART program reviews (included in the ExpectMore.gov pages) included:

Climate Program
The Climate Program was reviewed 2/6/2006. Individual component weights/scores: Purpose and Design (20%/80%); Planning (10%/90%); Management (20%/82%); Results (50%/74%) for an Average Score of 78.4%.

Tsunami Program
Tthe Tsunami program (part of the Weather and Water goal and is captured within this Sceintific Computing Support investment) was reviewed in FY08. The results were above expectation – 3 stars (effective). There has been no NOAA program ever reviewed for PART in the past that has gotten that high rating. Details here: http://www.whitehouse.gov/omb/expectmore/summary/10009082.2008.html

NOAA/Department of Commerce Review Process.

Budget Increase Review. ESRL's Carbon Observing and Analysis System (COAS) FY11 Increase for $8M, where $295K is for IT components. OAR requested through the NOAA Budget Office an increase for the COAS project to complete and sustain an observation and analysis system to determine uptake and emissions of carbon dioxide and greenhouse gases across North America. The NOAA Budget Office reviewed the Two-Page narrative through the PPBES normal chain. The NOAA Office of the CIO (NOAA OCIO) then reviewed the IT portion of the request through a desktop-exercise executed by NOAA OCIO staff. Other NOAA Research budget increases include projects within the High-Performance Computing and Communications program as well as the National Climate Model Portal; both of which are submitted and handled through other investments outside of the Scientific Computing Support area. Approval of the COAS increase is awaiting OMB Passback.

NOAA Research Review Process.

NOAA CIO Review Process. Each lab is represented by a Senior IT Manager. The Senior IT Managers meet annually face-to-face and weekly via teleconference with the NOAA Research CIO and staff to discuss the management and technical issues and challenges associated with DOC and NOAA policy as it impacts NOAA Research enterprise IT planning, IT security/information assurance, acquisition strategies, and web presence.

Laboratory Review Process. IT investments are reviewed by lab project managers to determine if Program benefits have been realized in areas such as lowered cost, reduced cycle time, increased quality, additional quantity of services, and increased speed of service delivery. Technology maintenance and refreshment is applied, if indicated in post implementation reviews, based on the following indicators, for COTS software, scientific desktop systems, applications, and server/networking equipment and services:

- upgrades - dependencies are vendor announcements of new technology and industry trends (e.g., Linux verses proprietary operating systems);
- refreshers - includes reaching a predefined age, component failure , repeated maintenance calls on the component failure to meet the system requirement, mission failure, planned obsolescence of the component resulting in the vendor's inability to maintain the component, vendor has gone of business or been acquired;

- insertion - dependencies are vendor or developer announcements of a product line that meets or increases component capability, vendor or developer announcements of a product line that decreases cost industry trends (e.g. Linux vs. proprietary operating systems), announcements of a milestone of research and development effort resulting in a new capability that can be applied to the laboratory or Program Office.

IT investments are refreshed with the periodic replacement of COTS components; e.g., processors, displays, computer operating systems, commercially available software (CAS), and communications capabilities within larger systems to assure continued supportability of that system through an indefinite service life under the following criteria:

- existing system component has malfunctioned and either cannot be repaired, or the repair costs exceed the replacement costs,
- existing system component has reached its life expectancy
- surrounding technical infrastructure has evolved and is incompatible with the existing component under consideration,
- newer technology has come to market that provides more capability for the same or lower Total Cost of Ownership, and
- requirements of the system have evolved to the extent that the system cannot meet the requirements with the existing technology

2.4 Security

The NOAA Research Scientific Computing Support systems are accredited under requirements spelled out by FISMA and the NOAA Security Memo NOA 212-13 that is based on OMB and NIST guidance. System Security Plans, Risk Assessments, and Contingency Plans are certified and accredited and are all current for all systems which are components of the NOAA Research Scientific Computing Support system. Management, operational, and technical security controls are adequate to ensure the confidentiality, integrity and availability of information.

All OAR systems contributing to the NOAA Research Scientific Computing Support system are currently holding ATOs (Authority to Operate). All Certification and Accreditaitons (C&A) have been completed for all OAR systems and are using the latest SP800-53 controls set forth by OMB. In addition, all systems are continuously monitored for security incidents by the NOAA Computer Incident Response Team (N-CIRT) and undergo quarterly vulnerability assessments. There is an annual continuous monitoring self-assessments of all security controls.

2.5 Performance Measures

Performance management at the NOAA corporate level consists of a suite of performance measures called Corporate Performance Measures (CPMs). These performance measures help the NOAA Administrator and senior management ensure the organization is moving towards strategic planning goals and outcomes, and organizational priorities. CPMs focus on high-level Program and Goal outcomes and the performance objectives that lead to these outcomes. They should serve to communicate NOAA's corporate performance to external audiences and provide a basis for the internal evaluation of NOAA's progress to plan.

The performance measures in Table 2 show the Scientific Computing Support's performance with respect to Strategic and Business Results. Strategic and Business Results performance measures introduced in [reporting year] include "[example measure]" and "[example measure]." These measures align with the "Mission and Business Results Measurement Area," "Processes and Activities Measurement Area" and the "Technology Measurement Area" of the Performance Reference Model developed by the FEA-PMO.

Table 2: Business Results Performance Measures

Measurement Area	Indicator	[reporting year – 1] Baseline	[reporting year] Actual Result	Comments
Strategic and Business Results	Reduce the uncertainty in the magnitude of the North American carbon uptake	+/- 0.4 gtC	+/- 0.4 gtC	
	U.S. temperature forecasts (cumulative skill score ove the regions where predictions are made)	19	20	
	Percentage of tools, technologies, and information services that are used by NOAA partners/customers to improve ecosystem-based management	86%	86%	

3.0 Financial Performance

3.1 Current Performance vs. Baseline

The Department of Commerce's Financial Management System (Cams, Mars, etc..) is used by OAR to track all financial obligations and commitments. The Budget Execution office with OAR ensures baseline and current spending are appropriated accordingly.

3.2 Performance Measures

Via the PPBES Quad Chart reporting, program performance measures are mapped to project milestone activities, planned and obligated budget spending, and any risks or issues with associated mitigati on strategies. The Scientific Computing Support investment spans over the following NOAA Goals: Climate, Weather and Water, and Ecosystem.

All End of Year quad charts are available in Appendix D

3.3 Cost Benefit Analysis

In 2009, NOAA CIO Office continued the process by which the PPBES Goal Team Leads annually provide planned costs for IT. The responses to the cost matrix are coordinated by the Goal Team Leads (e.g., Climate Program Office) and are intended to be used to assess the impact of alternat ives proposed to meet gaps in Program capabilities. IT planning costs are estimated in parallel with the Program Operational Plans (POPS) planning phase of the PPBES process.

Scientific Computing Support IT Investment FY2009 Planning Estimates are incl uded as a table below (using the latest Exhibit 53 from 2008 data).

Summary of Spending for Project Stages - Cost in thousands

	2009	2010	2011	2012	2013	2014	2015	2016	Total
Operations & Maintenance (in your E300, do not forget to subtract the OKEANOS Funding Increase in FY2009 - $700K changes total in row 10									$13,878.56
Budgetary Resources	$22,657.8	$23,448.4	$24,181.7	$24,921.3	$25,694.8	$26,504.5	$27,352.2	$28,251.7	$203,012.38
FS (without BY11 Increase)	$22,657.8	$23,448.1	$24,181.7	$24,921.4	$25,694.9	$26,504.5	$27,352.2	$28,251.7	
FS (including BY11 increase)	$22,657.8	$23,448.4	$24,476.7	$25,216.3	$25,989.8	$26,799.5	$27,647.2	$28,546.7	
Diff			$295.0	$295.0	$295.0	$295.0	$295.0	$295.0	
Government FTE Costs: Assumption is made that Govt FTEs are base funded, not funded from reimbursables.									
Budgetary Resources	$6,453.9	$6,691.6	$6,954.7	$7,230.1	$7,518.4	$7,820.4	$8,137.0	$8,468.6	$59,274.77
Ops & Maint. minus FTES and minus reimbursables	$13,749.7	$14,217.5	$14,578.6	$14,926.5	$15,290.7	$15,664.0	$16,051.8	$16,473.2	$120,952.03
BY11 MPAR (Did not get passback approval)			$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
BY11 Carbon (approved passback)			$295.0	$295.0	$295.0	$295.0	$295.0	$295.0	
Total with BR (No reimbursables)	$13,749.7	$14,217.5	$14,873.6	$15,221.5	$15,585.7	$15,959.0	$16,346.8	$16,768.2	
TOTAL (no reimb no BY11 increa	$20,203.6	$20,909.1	$21,533.3	$22,156.7	$22,809.1	$23,484.5	$24,188.8	$24,941.8	<---
Total with Reimb	$16,203.9	$16,756.7	$17,227.0	$17,691.2	$18,176.4	$18,684.1	$19,215.2	$19,783.2	
Reimbursables	$2,454.2	$2,539.3	$2,648.4	$2,764.6	$2,885.7	$3,020.1	$3,163.3	$3,309.9	
TOTAL (with Reimb)	$22,657.8	$23,448.4	$24,476.7	$25,216.3	$25,989.8	$26,799.5	$27,647.2	$28,546.7	
Total (no Reimb with BY11 increa	$20,203.6	$20,909.1	$21,828.3	$22,451.7	$23,104.1	$23,779.5	$24,483.8	$25,236.8	<---

Provide the number of Government Full Time Equivalents (FTE) represented by the Government FTE Costs in the Summary of Spending Table.

	2009	2010	2011	2012	2013	2014	2015	2016	Total
Security	7.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	53.95
IT	37.66	36.26	36.26	36.26	36.26	36.26	36.26	36.26	291.46
Financial Management	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.20	1.80
Program Management	0.90	0.50	0.50	0.50	0.50	0.50	0.50	0.50	4.40
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Number of FTEs	46.58	43.58	43.58	43.58	43.58	43.58	43.58	43.58	351.60

Funding Sources - Cost in thousands

FS Name: MAX Code	2009	2010	2011	2012	2013	2014	2015	2016	Total
NOAA ORF	$20,203.6	$20,908.8	$21,533.3	$22,156.7	$22,809.1	$23,484.5	$24,188.8	$24,941.8	$180,226.69
NOAA PAC	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.00
Other Agency Funding/non-NOAA Reimbursables	$2,454.2	$2,539.3	$2,648.4	$2,764.6	$2,885.7	$3,020.1	$3,163.3	$3,309.9	$22,785.59
Total Yearly Budgets	$22,657.8	$23,448.1	$24,181.7	$24,921.4	$25,694.9	$26,504.5	$27,352.2	$28,251.7	$203,012.27
Funding Sources Table in E300 includes $700K DME for OKEANOS									
ORF and PAC Only	$20,203.58	$20,908.81	$21,533.32	$22,156.72	$22,809.14	$23,484.47	$24,188.83	$24,941.80	$180,226.69
%ORF and PAC	0.892	0.892	0.890	0.889	0.888	0.886	0.884	0.883	
SECURITY	$1,968.15	$2,052.94	$2,144.98	$2,244.96	$2,354.11	$2,473.15	$2,603.19	$2,745.44	$18,586.92
$Security	$1,754.97	$1,830.62	$1,910.06	$1,995.92	$2,089.73	$2,191.35	$2,302.12	$2,423.79	$16,498.55
% Security	0.087	0.088	0.089	0.090	0.092	0.093	0.095	0.097	
	8.69%	8.76%	8.87%	9.01%	9.16%	9.33%	9.52%	9.72%	
HARDWARE	$2,308.13	$2,291.48	$2,379.19	$2,444.06	$2,511.18	$2,580.50	$2,652.17	$2,727.26	$19,893.97
$Hardware	$2,058.12	$2,043.32	$2,118.62	$2,172.93	$2,229.16	$2,286.47	$2,345.44	$2,407.73	$17,661.80
% Hardware	0.102	0.098	0.098	0.098	0.098	0.097	0.097	0.097	
SOFTWARE	$825.77	$798.80	$819.13	$840.14	$861.62	$884.09	$907.17	$930.95	$6,867.66
$Software	$736.32	$712.29	$729.42	$746.94	$764.85	$783.35	$802.25	$821.88	$6,097.31
% Software	0.036	0.034	0.034	0.034	0.034	0.033	0.033	0.033	
SERVICES	8898.907	9346.879	9550.188	9758.953	9973.497	10194.046	10420.730	10663.782	$78,806.98
$Services	$7,935.02	$8,334.67	$8,504.25	$8,676.35	$8,853.39	$9,032.49	$9,215.55	$9,414.42	$69,966.14
% Services	0.393	0.399	0.395	0.392	0.388	0.385	0.381	0.377	
OTHER (Facilities)	$431.85	$441.85	$452.17	$462.83	$473.92	$485.33	$497.19	$509.58	$3,754.72
OTHER (Training)	$1,098.19	$1,137.77	$1,179.65	$1,223.67	$1,270.10	$1,319.10	$1,370.62	$1,425.22	$10,024.32
OTHER (Telecon)	$672.92	$687.03	$701.64	$716.56	$732.00	$747.85	$764.12	$780.92	$5,803.04
OTHER (FTE)	$6,453.90	$6,691.61	$6,954.73	$7,230.11	$7,518.42	$7,820.44	$8,136.97	$8,468.59	$59,274.77
TOTAL	$8,656.86	$8,958.25	$9,288.20	$9,633.17	$9,994.44	$10,372.73	$10,768.90	$11,184.31	$78,856.85
$Other Services	$7,719.19	$7,988.13	$8,270.95	$8,564.52	$8,871.98	$9,190.81	$9,523.45	$9,873.97	$70,002.99
% Other Services	0.382	0.382	0.384	0.387	0.389	0.391	0.394	0.396	

3.4 Financial Performance Review

On an annual basis, the Senior IT Managers report to the lab Director to identify technical refresh requirements for software, hardware, and services to meet steady state operations within the laboratory's baseline IT budget. These requirements are prioritized and implemented as budgeted.

4.0 Innovation to Meet Future Customer Needs

On-site partnerships provide a unique opportunity for close collaboration, while sharing infrastructure costs, equipment, and personnel to make better use of technology and lower operating costs.

Facilities. In FY09, the GLERL laboratory just went through an extensive office move to a brand new location. A new building was recently built to accommodate for the office. GLERL's old office facility is very old and a lot of health issues (such as asbestos, lead, etc) have come to surface in the past decade. The new facility ensures continuity of operations and maintain its scientific preeminence.

Technology. The Department of Commerce-wide Enterprise License Agreement for Microsoft expired in FY2009. There were multiple efforts in creating a new enterprise agreement but eventually ended up each line-offices in NOAA doing their own. In June 2009, a comprehensive contract was put in place within OAR for an Enterprise Level Agreement for Microsoft, allowing each lab to participate in a heavily discounted pricing for desktop software products. The contract is for three years, which should give ample time to consider consolidation of Microsoft contracts with other LO's or eventually the Department.

Technology. Within recent years, NOAA Research Headquarters leadership implemented an OAR-wide Webcast. It aims to provide OAR employees information about NOAA, the organization, and any scientific accomplishments within the Line Office. In FY2009, the Webcast program continues to provide outreach and communications to the OAR community. It is scheduled quarterly and all laboratories within the OAR Line Office has the opportunity to get quarterly "live web-based broadcast" updates on anything NOAA and OAR.

Technology. Google Earth / Maps Applications are available for use within NOAA through the enterprise agreement with Google led by the NOAA CIO's office with the help of the GIS committee and representatives from each Line Office. In FY09, there is continued effort in utilizing Google Earth / Maps application in data dissemination / collaboration to the public on NOAA websites. An example of utilizing this technology by the labs within the Scientific Computing Support Investment include the ESRL / GMD Observation Sites map: http://www.esrl.noaa.gov/gmd/dv/site/map1.html,

4.1 Number and Types of Users

The fiscal year 2009 enacted budget for OAR totaled roughly $400M. The fiscal year 2010 President's budget request for OAR is roughly $410M. The NOAA OAR Budget Execution and Formulation Offices in OAR Headquadters has the exact details and budget numbers for the FY09 Enacted and the FY10 President's Budget.

OAR has 794 permanent Federal employees, 818 Associates, 463 Contractors and 14 Commissioned Officers.

Within NOAA, cross collaboration is across Line Offices (NWS, NESDIS, NOS, and NMFS) in support of other NOAA Programs such as NOAA's National Marine Sanctuary Program.

Partnerships also include other Federal agencies such as National Aeronautics and Space Administration and the U.S. Department of Energy.

Other partnerships include the National Center for Atmospheric Research (NCAR), a National Science Foundation federally funded research and development center.

And university partnerships, such as the Western Water Assessment. (http://wwa.colorado.edu/about/index.html).

The Assessment was created in 1999 and is a joint effort between the Cooperative Institute for Research in Environmental Sciences at the University of Colorado and the National Oceanic and Atmospheric

Administration's Climate Diagnostics Center. Both entities are located in Boulder, Colorado. The WWA director and 2 research associates are both housed in ESRL/PSD.

Each laboratory is also co-located, under a DOC/NOAA/OAR Formal Research Partnership, with a Joint and Cooperative Institute.

Over the past thirty two years, the Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), Office of Oceanic and Atmospheric Research (OAR) through its NOAA Research Laboratories has developed research partnerships to form the Joint Institutes. Each of these Joint and Cooperative Institutes are formal, collaborative long-term research partnerships established under a Memorandum of Understanding (MOU)/Agreement (MOA) between NOAA through the Office of the Under Secretary of Oceans and Atmosphere and participating universities and non-profit research institutions with programs dedicated to oceanographic and/or atmospheric research, education and outreach. By design, most of the Institutes are geographically co-located with one or more NOAA facilities to promote scientific interchange and collaboration.

The primary purpose of each Institute is to create a mechanism to bring together the resources of a research-oriented university or institution, OAR and other branches of NOAA in order to develop and maintain a center of excellence in research relevant to understanding the Earth's oceans, the Great Lakes, inland waters, Arctic regions, solar terrestrial environment, inter-mountain west and the atmosphere. These partners provide a pooling of resources for studies to produce the best possible interdisciplinary scientific research and outreach. These exceptionally worthwhile undertakings are substantial, long enduring and represent a synergy that has brought together NOAA, premier academic and oceanographic institutions in a mutually beneficial arrangement to address issues of national and international significance unique to these partnerships.

For detailed information see Appendix B below.

4.2 Funding Levels

Finding efficiencies to do more with the same amount of resources.

For FY2009, the breakout for the E300 SCS IT costs were: 3.33% for software; 10.69% hardware; 38.86% services; 29.42% Gov't FTE, and 9.22% other (facilities and other). IT Security Cost was at 8.48%, which is above the NOAA OCIO planning guidance for IT Security spending on NOAA initiatives.

Software Licensing and Maintenance. All of NOAA has benefited from NOAA Research's efforts to work with the NOAA Acquisition Community and COTS software publishers in negotiating enterprise software licensing BPAs and Contracts. These products can be costly since they serve a "niche" market of scientists and researchers.

For example, NOAA holds a contract for Interactive Data Language (IDL) – software for data analysis, visualization, and cross-platform application development. The original 5 year contract for IDL software was awarded in 2000 as site licensing to OAR and NESDIS. The contract was re-negotiated in 2006, and NWS NCEP was added as another "site". The commercial cost of a floating network license is $3,900; a single license is $3,000, and a node locked license $2,400; pricing includes one year of maintenance. Under this contract, the FY2006 annual renewal cost for over a 1000 programmers within these Line Offices was $128,000 (approximately $128 per user). NCEP's 200 users paid $175 for a license and a year of maintenance under the new contract. The cost avoidance for NCEP alone, at single license fees, was 58%. This contract is still in effect in FY2009 and has benefited numerous other programs within NOAA.

Another cost-efficiency for enterprise software licensing is for Linux (the basic workstation entitlement is discounted 40% from list). The existing BPA with Red-Hat expired in FY2008 and it has been re-negotiated and re-awarded for another three years. This contract BPA has benefited NOAA as an enterprise and will continue to do so in the future.

The NOAA CIOs as a team effort, out of their own IT budgets, fund the contract for ISIResearchSoft EndNote, ProCite, and Reference Manager publishing software. Researchers and librarians use EndNote to search online bibliographic databases, organize their references, images and PDFs in any language, and create bibliographies and figure lists instead of spending hours typing bibliographies, or using index cards to organize their references. EndNote is a valuable all-in-one publishing tool for both Windows and MacIntosh platforms. The site licensing annual renewal, which includes home use, costs $21,600. A single license is priced at $240. The current contract is in its third option year and has continued to provide cost savings for NOAA since it is an enterprise volume license buy.

Appendix A

Earth Systems Research Laboratory (ESRL) – http://www.esrl.noaa.gov/

The Earth System Research Laboratory's mission is to observe and understand the Earth system and to develop products through a commitment to research that will advance the National Oceanic and Atmospheric Administration's (NOAA's) environmental information and services on global-to-local scales. The work at the Earth System Research Laboratory includes:

- understanding the roles of gases and particles that contribute to climate change,
- providing climate information related to water management decisions,
- improving weather prediction,
- understanding the recovery of the stratospheric ozone layer, and
- developing air quality forecast models.

National Severe Storms Laboratory (NSSL) – http://www.nssl.noaa.gov/

NSSL studies severe and hazardous weather processes and develops tools to help National Weather Service forecasters, and federal, university and private sector partners use weather information more effectively.

The three research divisions - Forecast, Warning, and Radar - carry out NSSL's core science by blending resources, talent, knowledge and shared goals to:

- Develop enhancements to existing weather radar, and to design and test a new radar system.
- Develop and test tools to improve forecasts and warnings.
- Develop hydrometeorology tools for severe storm monitoring and prediction
- Carry out field research to improve the basic understanding of severe storm processes.

Pacific Marine Environmental Laboratory (PMEL) – http://www.pmel.noaa.gov/

PMEL carries out interdisciplinary scientific investigations in oceanography and atmospheric science. Current PMEL programs focus on open ocean observations in support of long-term monitoring and prediction of the ocean environment on time scales from hours to decades. Studies are conducted to improve our understanding of the world's oceans, to define processes driving the global climate system, and to improve environmental forecasting capabilities for public safety, marine commerce, and fisheries.

Ocean Environment Research

- Tsunami (hazard mitigation)
- VENTS (hydrothermal studies)
- FOCI (fisheries oceanography)
- SEBSCC (ecosystem studies)

Ocean Climate Research

- Argo Profiling Floats
- Atmospheric Chemistry
- Carbon Dioxide
- Chlorofluorocarbons
- TAO (buoy array)
- TMAP (equatorial ocean modeling)

Atlantic Oceanographic and Meteorological Laboratory (AOML) – http://www.aoml.noaa.gov/

AOML's mission is to conduct basic and applied research in oceanography, tropical meteorology, atmospheric and oceanic chemistry, and acoustics. The research seeks to understand the physical characteristics and processes of the ocean and the atmosphere, both separately and as a coupled system.

The Physical Oceanography Division of AOML carries out interdisciplinary scientific investigations in the field of Ocean and Climate. Specific research goals are: Determine the role of the ocean in long term climate change; Study ocean variability and its influence on short term climate and weather and to provide data analysis and assimilation tools for ocean prediction.

PhOD is a main partner in the development of a sustained Ocean Observ ing system for Climate to support NOAA mission requirements. As such the overall mission of the Physical Oceanography Division of AOML is to provide quality ocean data and products in a timely and cost-effective manner to satisfy NOAA nowcast, forecast, detection, attribution and research mission requirements.

The Hurricane Research Division (HRD) is a part of the Atlantic Oceanographic and Meteorological Laboratory (AOML). We are engaged in advancing the basic physical understanding and improving the forecasts of hurricanes and tropical meteorological systems. A key aspect of HRD's activity is its annual field program of flights aboard NOAA's research aircraft (two WP-3D turboprops and a Gulfstream IV-SP jet) flown by NOAA's Aircraft Operations Center.

The Ocean Chemistry Division (OCD) is one of the four scientific research divisions within the Atlantic Oceanographic and Meteorological Laboratory (AOML). The diverse Ocean C hemistry Division scientific staff is comprised not only of chemical oceanographers and atmospheric chemists but also biological oceanographers and geologists. OCD typically employs multi-disciplinary approaches to solve scientific research questions central to National Oceanic and Atmospheric Administration (NOAA) mission requirements. The division's work includes projects that are important both in enhancing our basic understanding of the coupled atmospheric/ocean system but also in assessing the current and future effects of human activities on the coastal and oceanic environments. Detailed information about specific research projects can be found within the major research areas section of this site.

Great Lakes Environmental Laboratory (GLERL) – http://www.glerl.noaa.gov/

GLERL was formed in 1974 to provide a focus for NOAA's environmental and ecosystem research in the Great Lakes. GLERL conucts high-quality research and provides scientific leadership to understand, observe, assess, and predict the status and changes of Great Lakes and coastal marine ecosystems to educate and advise stakeholders of optimal management strategies.

Presently GLERL's research resides under NOAA's Ecosystem Goal Team specifically in the Ecosystem Research Program. During its history, GLERL has made many important scientific contributions to the understanding and management of the Great Lakes and other coastal ecosy stems. GLERL scientists thus play a critical role in academic, state, federal, and international partnerships, and GLERL research provides information and services to support decisions that affect the environment, recreation, public health and safety, and the economy of the Great Lakes and coastal marine environments. GLERL's main science issue areas are Physical Environment , Water Quantity, Water Quality, Human Health, Fish Recruitment and Productivity, and Invasive Species

Air Resources Laboratory (ARL) – http://www.arl.noaa.gov/

The Air Resources Laboratory (ARL) studies processes and develops models that relate to air quality and climate, concentrating on technology development and transfer relating to the transport, dispersion, transformation and removal of trace gases and aerosols (the exchange between the atmosphere and the surface), and the role of natural variability. The time frame of interest ranges from minutes to that of the global climate.

ARL research is aligned with the four thematic areas of NOAA Research; **weather and air quality**, **coastal and ocean resources**, **climate**, and **technology development and transfer**, with emphases on homeland security, coastal ecosystems, and arid-zone environments. The specific goal of ARL research is to improve and eventually to institutionalize prediction of air quality, atmospheric deposition, and related variables. ARL operates with research divisions in Idaho Falls, Idaho; Research Triangle Park, North Carolina; Las Vegas, Nevada; Oak Ridge, Tennessee; and Silver Spring, Maryland. On October 1, 2005, the Surface Radiation Research Branch in Boulder, Colorado, formerly a division of the Air Resources Laboratory, was merged into the Earth System Research Laboratory (ESRL).

Geophysical Fluid Dynamics Laboratory – http://www.gfdl.noaa.gov/

The goal of this research is to expand the scientific understanding of the physical processes that govern the behavior of the atmosphere and the oceans as complex fluid systems. These systems can then be modeled mathematically and their phenomenology can be studied by computer simulation methods. GFDL research concerns the predictability of weather on large and small scales; the structure, variability, predictability, stability and sensitivity of global and regional climate; the structure, variability and dynamics of the ocean over its many space and time scales; the interaction of the atmosphere and oceans, and how the atmosphere and oceans influence and are influenced by various trace constituents; the Earth's atmospheric general circulation within the context of the family of planetary atmospheric circulations.

The scientific work of the Laboratory encompasses a variety of disciplines including meteorology, oceanography, hydrology, classical physics, fluid dynamics, chemistry, applied mathematics, and numerical analysis. Research is also facilitated by the Atmospheric and Oceanic Sciences Program (AOSP), which is a collaborative program at GFDL with Princeton University. Under this program, regular Princeton faculty, research scientists, and graduate students participate in theoretical studies, both analytical and numerical, and in observational experiments in the laboratory and in the field. The program is supported in part by NOAA funds. AOSP scientists may also be involved in GFDL research through institutional or international agreements.

Appendix B

Number and Types of Users – University Partnerships

The Joint Research Institutes bring together the resources of a research-oriented university or institution, OAR and other branches of NOAA in order to develop and maintain a center of excellence in research relevant to understanding the Earth's oceans, the Great Lakes, inland waters, Arctic regions, solar terrestrial environment, intermountain west and the atmosphere.

Cooperative Institute for Arctic Research (CIFAR)

Fairbanks, AK--
CIFAR is designed to serve as a focal point for interactions between NOAA and the Arctic research community through the University of Alaska for research activities related to NOAA's tasks and responsibilities in the Arctic. CIFAR conducts research on a wide variety of issues critical to the Arctic, including fisheries oceanography, hydrographic studies and sea ice dynamics, atmospheric research, climate dynamics and variability, tsunami research and prediction, and environmental assessment and monitoring. CIFAR works closely with researchers from the eight countries of the Arctic Council on climate impact assessments, and is planning joint oceanographic cruises with Russia.

Cooperative Institute for Atmospheric Sciences and Terrestrial Applications (CIASTA)

Las Vegas/Reno, NV--
CIASTA is a cooperative institute among NOAA and the University and Community College System of Nevada (UCCSN). CIASTA is administered by the Desert Research Institute on behalf of the UCCSN. CIASTA brings a formalized focus to a number of research projects and programs encompassing weather research, climate, air quality and terrestrial ecosystems studies related to global change and hydrology and water supply in the arid regions typical of the intermountain West. CIASTA supports university researchers, postdocs and students.

Cooperative Institute for Climate Applications and Research (CICAR)

Palisades, NY--
CICAR is a cooperative institute between NOAA and Columbia University, New York. CICAR research themes include the modeling, understanding, prediction and assessment of climate variability and change; development, collection, analysis and archiving of instrumental and paleoclimate data; and development of the application of climate variability and change prediction and assessment to provide information for decision makers and assess risk to water resources, agriculture, health, and policy. CICAR brings together scientists from NOAA Laboratories, in particular the Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey, and scientist of the Earth Institute at Columbia University, in particular the Lamont Doherty Earth Observatory.

Cooperative Institute for Climate and Ocean Research (CICOR)

Woods Hole, MA--
CICOR is a cooperative institute between NOAA and the Woods Hole Oceanographic Institution. The research activities of CICOR will be organized around three themes: the coastal ocean and near-shore processes, the ocean's participation in climate and climate variability, and marine ecosystem processes analysis. These theme areas, each of which has significant implications for human society, are interrelated, and scientific progress will require collaborations by scientists within and between disciplines. In each case, progress will depend on a combination of fundamental process studies, the development and deployment of technological systems for sustained observation, and the development of predictive models that are based on an understanding of the underlying processes and that assimilate information from observational systems.

Cooperative Institute for Climate Science (CICS)

Princeton, NJ--
CICS is built upon the strengths of Princeton University in biogeochemistry, physical oceanography, paleoclimate, hydrology, ecosystem ecology, climate change mitigation technology, economics and policy; and those of GFDL in modeling the atmosphere, oceans, weather and climate. CICS is an

outgrowth of a highly successful forty-year collaboration between Princeton University's Atmospheric and Oceanic Sciences (AOS) Program and GFDL that contributed to the development of oceanic and atmospheric models, performed research on climate and biogeochemical cycling and educated several generations of postdoctoral researchers and graduate students. T he establishment of CICS enhances and extends this long-term partnership by incorporating Princeton University faculty affiliated with the interdisciplinary Princeton Environmental Institute (PEI), thereby augmenting its expertise in the sciences, engineering and policy and facilitating new research collaborations.

Cooperative Institute for Limnology and Ecosystems Research (CILER)

Ann Arbor, MI--
CILER is a cooperative institute between NOAA and the University of Michigan with formal links to Michigan State University and other universities in the Great Lakes Basin. CILER's research activities are organized around five research themes: climate and large-lake dynamics; coastal and nearshore processes; large-lake ecosystem structure and function; remote sensing of large lake and coastal ocean dynamics; and marine environmental engineering. The Institute supports research scientists, postdoctoral research fellows, research support staff, and students at the University of Michigan and other Great Lakes universities.

Cooperative Institute for Marine and Atmospheric Studies (CIMAS)

Miami, FL--
CIMAS is a cooperative institute between NOAA and the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences. Research is conducted within three themes --Climate Variability, Fisheries Dynamics, and Coastal Ocean Ecosystem Processes --in collaboration with ERL and the National Marine Fisheries Service. CIMAS supports 45 university researchers, postdocs, graduate students, and staff.

Cooperative Institute for Mesoscale Meteorological Studies (CIMMS)

Norman, OK--
CIMMS is a cooperative institute between NOAA and the University of Oklahoma. Research fields include basic convective and mesoscale forecast improvements, and climatic effects of controls on mesoscale processes, socioeconomic effects of mesoscale weather systems an d regional scale climate variations. The Institute collaborates with the National Severe Storms Lab, and supports the NWS modernization efforts in Norman. CIMMS supports ~130 university researchers, postdocs, students, and staff.

Cooperative Institute for Research in the Atmosphere (CIRA)

Fort Collins, CO--
CIRA is a cooperative institute between NOAA and Colorado State University. The Institute conducts research involving global and regional climate, local an d mesoscale area weather forecasting and evaluation, applied cloud physics, applications of satellite observations, air quality and visibility, societal and economic impacts, numerical modeling, and education, training and outreach. The Institute provides an interdisciplinary forum for research collaboration among university scientists/postdocs/staff/students and several NOAA laboratories and line elements including OAR (the Forecast Systems Laboratory and the Environmental Technology Laboratory, the NWS an d the NESDIS (Office of Research Applications, Office of Satellite Development and the Data Centers).

Cooperative Institute for Research in Environmental Sciences (CIRES)

Boulder, CO--
CIRES is a cooperative institute between NOAA and the University of Colorado. The Institute conducts research in environmental chemistry and biology, atmospheric and climate dynamics, cryospheric and polar processes, and the solar-terrestrial environment, and brings together government and university researchers, post docs, and students from eight university departments and several NOAA laboratories in a wide-ranging array of scientific collaborations and interdisciplinary research.

Joint Institute for Marine and Atmospheric Research (JIMAR)

Honolulu, HI--

JIMAR is a cooperative institute between NOAA and the University of Hawaii. Research Foci include equatorial oceanography, climate research, tsunamis, fisheries oceanography , tropical meteorology and coastal research. In addition to its partnerships with OAR , JIMAR works closely with the Pacific Regions of the National Marine Fisheries Service and the National Weather Service as well as the Coastal Services Center, Honolulu. JIMAR supports 140 university researchers, post doc, students and staff. JIMAR is housed in the University of Hawaii School of Ocean and Earth Sciences and Technology as are two OAR partners; the Hawaii Sea Grant College Program and the Hawaii Undersea Research Laboratory.

Joint Institute for Marine Observations (JIMO)

La Jolla, CA--

JIMO, located on the Scripps La Jolla campus, is a joint institute between NOAA and the University of California's Scripps Institution of Oceanography. JIMO is collocated with the NOAA Southwest Fisheries Center and maintains collaborative programs with several of the NOAA Laboratories across the country, representing a wide range of mutual interests. The overall goal of JIMO is to create a center of excellence in which the state of the art observation capabilities such as platforms (surface, subsea, and air/spaceborne), sensors, and systems architecture of both NOAA and Scripps are utilized to fill pressing research needs. The specific themes reflect the particular strength at Scripps in the areas of coupled ocean-atmosphere climate research, blue water and littoral oceanography, marine biology/biological oceanography, marine geology and geophysics, and ocean technology. It also lends the strength of the Scripps large fleet of surface and subsurface platforms to the success of observation -based science for NOAA.

Joint Institute for the Study of the Atmosphere and Ocean (JISAO)

Seattle, Washington--

JISAO is a cooperative institute between NOAA and the University of Washington and complements the research at PMEL in climate variability, environmental chemistry, estuarine processes and interannual variability of fisheries recruitment. JISAO supports 35 university researchers, postdocs, and students.

Appendix C

NOAA Dives into Ocean in Google Earth

Visitors to a new element of a popular online Earth exploration tool will discover an abundance of NOAA information and images during their journey. Google Earth today unveiled Ocean in Google Earth, a new way for online explorers to dive into the ocean's depths. The launch of Ocean in Google Earth took place in San Francisco.

High resolution (Credit: NOAA)

"This allows anyone, anywhere at any time to explore virtually the ocean from their home computer," said Richard Spinrad, NOAA assistant administrator for oceanic and atmospheric research. "And during their journey, they will benefit from abundant contributions of information and imagery supplied by NOAA."

Spinrad serves on the Ocean in Google Earth advisory board.

NOAA contributed and will continue to contribute a variety of data and imagery to the project. Some of the expeditions from the NOAA Office of Ocean Exploration and Research, such as a trip to the submerged wreck of the Titanic, and information and ocean current maps demonstrating marine debris movement from the NOAA Marine Debris Program are included. NOAA also provides data from NOAA's National Data Buoy Center and seabed maps of U.S. coastal waters.

Other NOAA contributions include information on marine protected areas including the 13 U.S. national marine sanctuaries and one marine national monument that are highlighted in detail via underwater video footage, high resolution seabed maps, and photography.

"Presenting NOAA information in this way is not only exciting, but also gives the public a better understanding of NOAA's ocean mission," Spinrad said. "We're also very excited that more young users may become interested in marine science careers while adults can learn more about the myriad issues affecting our ocean. Of course, everyone can enjoy the magnificent beauty of life below the water's surface."

NOAA understands and predicts changes in the Earth's environment, from the depths of the ocean to the surface of the sun, and conserves and manages our coastal and marine resources.

Appendix C

NOAA Research Scientific Computing Support Investments - PPBES End of Year Quad Charts
Climate, Ecosystem (or Oceans, Coasts and Great Lakes Research) and Weather & Water

OAR Research for Climate Chart as of 4th Quarter FY2009

Relevant Performance Measures

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Measure	Q4 planned	Q4 actual	FY 09 Target
GPRA: U.S. Temperature Forecasts (Cum. Skill Score)	20	27.5	20
GPRA: Reduce uncertainty in North American carbon uptake	N/A	0.40 (annual)	0.40 GtC/yr
GPRA: Explained variance (%) for US temperature/precipitation	98.3/ 95.1	98.3/95.1	98.0/95.0%
GPRA: Reduce uncertainty in model simulations of the influence of aerosols on climate	N/A	20% (annual)	20%
GPRA: Reduce error in measurement of global SST	N/A	0.50 (annual)	0.50C
GPRA: Number of regionally focused climate impacts and adaptation studies communicated to decision-makers.	N/A	37 (annual)	37
CCSP Milestones			
CCSP Milestones	0	0	5

Schedule (FY 2009)

Y

Q4 Milestones Planned = 15	Q4 Milestones Met = 15

FY2009	Q4		
Key Milestones (other milestones in notes)	Jul	Aug	Sep
Deploy 120 floats (60 PMEL and 60 AOML) to sustain U.S. contribution to Int'l ARGO program			◆
Conduct initial decadal prediction experiments in support of IPCC AR5 report.			◆
Initiate assessment of the GFDL Coupled Model as a potential member of a National Multi-Model Ensemble			◆
Produce a 120 year long climate reanalysis using a next generation model			◆
Initiate design of the Colorado Basin and Southeast U.S. drought earlywarning information systems including tailoring the US Portal and forecasts to the regional scale			◆
Install 40 Soil Moisture/Temperature Sensors on Existing CRN Stations.			◆
Develop Climate Portal prototype website.			◆
Planned Completion ◆ Actual Completion ◆ Not Met ◆			

Key Issues/Risks

Y

Issues/Risks:

Soil Moisture sensors: Program installed 35 out the planned 40 for FY09. Delayed due to problems with a batch of sensors from the manufacturer that was beyond our control. We deem FY09 a success given the newness of this sensor suite and getting a bit of a late start (April 2009) to ensure the science behind the installations was right. FY10 and FY11 plan is to install 40 sensors each year.

Climate Goal Q4 Accomplishments:

- All milestones but one were completed for the quarter.
- U.S. Temperature Forecasts skill score was exceeded.

Budget/Funding (FY

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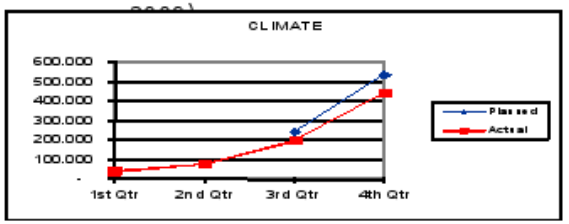

Obligations (In 000's)	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
Planned			237,310	536,228
Actual	39,110	77,309	197,125	443,190
Variance	(39,110)	(77,309)	40,185	93,038

AR Research for Oceans, Coasts, and Great Lakes Resear
as of 4th Quarter 2009

Relevant Performance Measures

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CPM/Other Measure	This Q planned	This Q actual	FY09 ERP Target	FY09 ERP Actual (Q1-4)
Annual number of coastal, marine, and Great Lakes ecological characterizations that meet management needs.	38	38	50	49
Cumulative number of coastal, marine, and Great Lakes issue-based forecast capabilities developed and used for management.	3	3	41	41
Number of tools, technologies, and information services that are used by NOAA partners/customers to improve ecosystem-based management.	38	38	38	38

Schedule (FY 2009)

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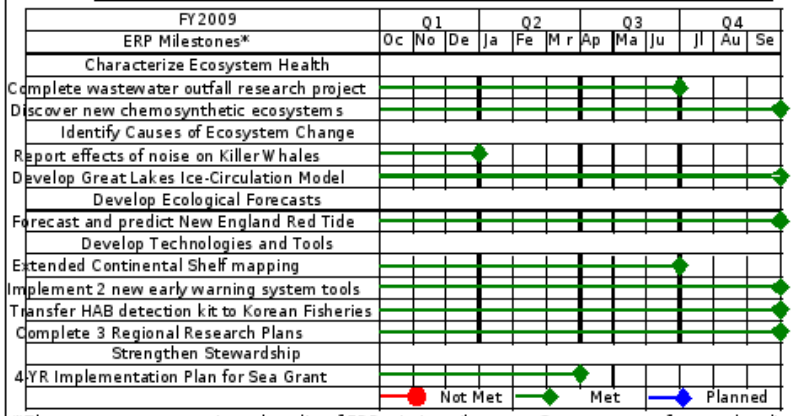
Q4 Milestones Planned = 31 | Q4 Milestones Met = 29



*These are a representative subset list of ERP priority milestones. See notes page for complete list.

Key Issues/Risks

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Issue: Not all Sea Grant programs have been aligned to the National Plan at the end of Q4 as planned.
Risks: Low
Mitigation: This milestone needs to change from Q4 in 2009 to Q1 in 2010. A small advisory committee was to review all state plans in Q3 of 2009, in which most state sea grant plans will be completed and aligned, but some programs have decided to rewrite their planning documents. They anticipate their completed plans will be aligned by Q1 of 2010.

Issue: The draft Chesapeake Bay IEA Version II was not produced.
Risks: Low
Mitigation: The client no longer wants this document as currently written.

Budget/Funding (FY 2009)

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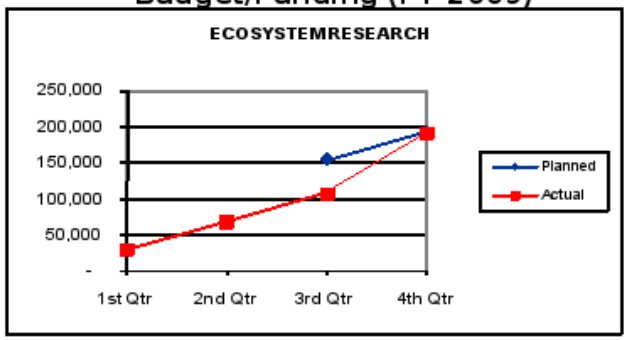

Obligations (in 000's)	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
Planned			153,230	192,934
Actual	29,716	67,878	106,712	190,163
Variance	(29,716)	(67,878)	46,518	2,772

OAR Research for Weather & Air Quality Quad Chart as of 4th Quarter FY2009

G Relevant Performance Measures

Measure	4th Q planned	4th Q actual	FY 09 Target
Efficiency in collecting wet deposition observations	85%	85%	85%
Lead time for tornadoes	TBD	16 min (20 min)	Conduct 2007 HWT Spring Experiment, focusing on mesoscale and cloud-scalse ensemble forecasts
Flash flood lead time	49 min	68 min	49 min
Hurricane Intensity Forecasts (48 Hrs)	13% Improvement	n/a	13% Improvement

G Key Issues/Risks

- AWIPS router technology replacement will be completed in 1st Qtr of FY10 (4 sites remain)
- Q2 Hydrometer classification logic for snowrates will be completed in 1st Qtr of FY10
- Statistical Study of Q2 product accuracy will be competed in 1st Qtr of FY10
- NASA delayed Global Hawk until January 2010
- Assessment of Surplus DoD UAS Acquisition to be completed by December 2010
- Pacific UAS testbed demo on for November 2009
- Gulf/Atlantic UAS demo replaced by major collaborative test with NASA in FY10

G Schedule (FY 2009)

Q4 Milestones Planned = 4	Q4 Milestones Met = 4

FY2009	Q1			Q2			Q3			Q4		
Milestone	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Finalize NOAA science plan for 2010 assessment												◆
Install GPS-Met receivers to provide heavy precip data and process for Hydromet Testbed's winter season and provide report input												◆
Complete report on initial evaluatio of 4 Transition Projects (ensemble QPFs; Moisture Flux Tools; Snow Information Tools; Atmospheric River Tools).												◆
Comple & Integrate six Tsunami Forecast Models into the Prototype Tsunami Forecast System developed for NOAA/NWS Tsunami Warning Centers												◆

G Budget/Funding (FY 2009)